VIEW

OF

THE MINERALOGY, AGRICULTURE, MANUFACTURES AND FISHERIES

OF

THE ISLAND OF ARRAN.

WITH

NOTICES OF ANTIQUITIES,

AND

SUGGESTIONS FOR IMPROVING THE AGRICULTURE AND FISHERIES OF THE HIGHLANDS AND ISLES OF SCOTLAND.

BY THE REV. JAMES HEADRICK.

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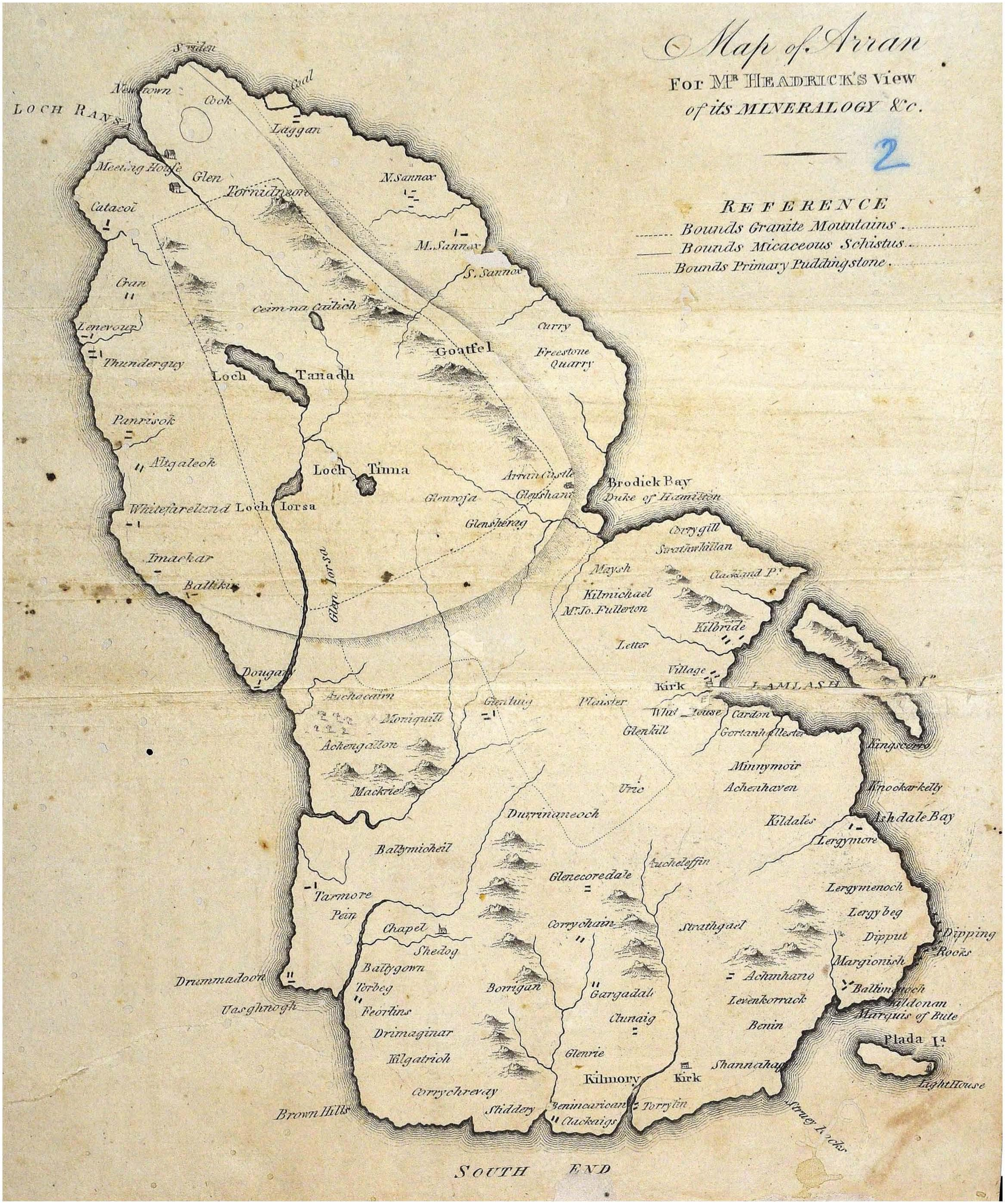
Map of Arran
For Mr HEADRICK'S View
of its MINERALOGY &c.
2
REFERENCE
Bounds Granite Mountains
Bounds Micaceous Schistus
Bounds Primary Puddingstone
LOCH RANSA
Newtown
Cock
Laggan
Meeting House
Glen
Catacol
N. Sannox
M. Sannox
S. Sannox
Gran
Ceim-na Cailich
Lenevour
Thunderguy
Curry
Goatfel
Freestone Quarry
Loch Tanach
Panrisok
Altgaleok
Loch Tinna
Arran Castle
Brodick Bay
Duke of Hamilton
Whitefareland
Loch Iorsa
Glenrosa
Glenshant
Glensherag
Corrygill
Imackar
Mayish
Kilmichael
Mr. Jo. Fullerton
Glen Iorsa
Kilbride
Letter
Dougarie
Village
Kirk
LAMLASH
Auchacairn
Moniquill
Plaister
Achengallon
Cardon
Glenkill
Minnymoir
Achenhaven
Knockarkelly
Mackrie
Urie
Kildales
Ashdale Bay
Durrinaneoch
Ballymicheil
Lergymore
Glenecoredale
Tarmore
Pein
Lergymenoch
Lergy beg
Chapel
Shedog
Corrychain
Strathgael
Dippin
Dipping Rocks
Ballygown
Torbeg
Margionish
Drummadoon
Borrigan
Gargadal
Achnhano
Levenkorrack
Kildonan
Marquis of Bute
Feorlins
Clunaig
Benin
Drimaginar
Pladda Id
Kilgatrich
Glenrie
Kilmory
Kirk
Shannahay
Light House
Corrychrevay
Brown Hills
Sliddery
Torrylin
Clackaigs
SOUTH END

3
1357

TO

THE RIGHT HONOURABLE

SIR JOSEPH BANKS, K. B.

PRESIDENT OF THE ROYAL SOCIETY,
&c. &c. &c.

SIR,

YOUR perſevering, meritorious, and ſucceſsful exertions, to extend the bounds of Science, and to render it ſubſervient to Agriculture, and other uſeful arts, encourage me to inſcribe the following pages to you. They conſiſt of inquiries which owed their commencement in this country to your animating example. A detailed account of one of the Hebridian Iſles, not unintereſting to the geologiſt, cannot find a more deſirable ſhelter for its many imperfections, than under the patron-

age of that man, who first discovered made known the wonders of Staffa, the greatest mineral curiosity of the Hebrides, if not of the world.

I inscribe these pages to you, Sir, with the greater pleasure, as it affords me an opportunity of expressing my gratitude for the kindness and civilities I experienced from you while in London; and of manifesting my esteem for your talents and virtues.

I have the honour to remain, with the highest respect,

SIR,

Your most obedient,

and very humble Servant,

JAMES HEADRICK.

EDINBURGH,
May 12. 1807.

THE author of the following work, having been occaſionally employed, during ſeveral years, by reſpectable noblemen and gentlemen, in making agricultural and mineralogical ſurveys of their properties in the Highlands and Iſles of Scotland, humbly flatters himſelf he has collected a maſs of facts, which are not only intereſting to the individuals who employed him, but to the public at large. Under this impreſſion he ventures to iſſue a volume, as a ſpecimen of other ſimilar works, if this ſhould be ſo fortunate as to meet with public approbation.

It may be neceſſary to enter into an explanation of the plan which the author has ad-

opted, and which he means to follow out should he be encouraged to publish other similar works.

He alludes chiefly to the mineralogical department of his work. On the one hand, he might have presented an arranged list of all the rocks and minerals he observed in Arran. But this would have only shown the materials of which the building was constructed; while it kept out of view the skill of the Architect, and the order in which He had chosen to arrange them. The plan he has chosen is that of locality; dividing the island into districts, marked by natural boundaries; and describing each mineralogical phenomenon in the order in which it would occur to a traveller who chose to follow the same route. Though conscious that this plan necessarily induces a frequent repetition of the same ideas, the author cannot see how this repetition can be avoided, without rendering himself unintelligible.

The

The author anticipates another objection—That his deſcriptions of minerals are too long-winded, and tireſome. To this objection he pleads *guilty*; and the only defence he would humbly offer, is, that Mineralogy being made up of a *ſlang*, unmeaning, and diſguſting, to men of intelligence; and being, further, adumbrated by crude and abſurd theories, ſhe cannot yet rear her head, and aſſume the rank of a ſcience. Mineralogy never can be raiſed to the rank of a ſcience by picking up ſtones along a ſea-beach, or by compoſing crude theories from ſpecimens collected in the cloſet. This deſire-able effect can only be produced by grappling with mountains; by accurate obſervation; and by minute deſcription of nature.

No ſubject calls more loudly for reform than the nomenclature of Mineralogy. Every one is ſenſible of the great advantage which Chemiſtry has derived from an improved, though imperfect nomenclature. It is thought the

same method might be followed with Mineralogy, and that names might be invented which would at once express the chemical composition, together with the most striking external character of minerals. Until this is done, the author generally contents himself with the names commonly used in this country; and when foreign words are introduced, he is anxious to explain the sense in which he uses them. His sole wish is to be understood,—as he views mineralogy in subserviency to agriculture in determining the quality of soils.

He has annexed descriptions of the rocks which occurred, by the late Dr Walker, who may be justly reckoned the father of Mineralogy in this country. These were dictated in Latin, a few months before his death; and are a summary of more than twenty volumes of remarks on minerals, collected by the Doctor during his long and laborious life. It was edifying to behold a man, venerable by years and

useful

useful labours, after he was stone-blind, was worn down by indisposition and by domestic affliction, stifling his inward sorrows, and displaying all the ardour of youth in scientific pursuits.

With regard to the shells described (p. 293.) as abounding in basaltic columns, at *Garbhe*, one of the Shiant Isles, some further explanation seems necessary. The author has learnt, with regret, that Dr Hope, Professor of Chemistry in this University, had landed in the bay alluded to, but did not see the shells. In fact, the shells are not precisely in the bay; but in the range of columns situated between the bay and a wacken promontory through which the sea has formed a stupendous arch. The circumstance that led the author to observe these shells, was, having landed in the bay from a small skiff, a violent squall arose, which obliged the people to run for safety through the arch described. The author was

obliged to ſcramble over the columnar fragments to the wacken promontory, before he could regain the boat. It was during this ſcramble that he obſerved numerous ſhells, firſt in the baſaltic fragments, and afterwards traced them in the lower parts of columns of great altitude. If any perſon has the curioſity to examine this ſingular fact, it is hoped this explanation is ſo full and preciſe, that he cannot fail to obſerve it. Without the accident alluded to, the author would not have come in the way of the ſhells.

Arran is commonly reckoned an epitome of the mineral ſtructure of the globe, exhibiting, in regular progreſſion, the ſucceſſive formations of ſtrata, from the primary granite to the lateſt formed ſandſtone. It has hence been much reſorted to by our world-makers, who were in queſt of arguments to ſupport their theories. This may be pleaded as another excuſe for a more elaborate expoſition of the facts that

were obſerved, than might otherwiſe be neceſſary. It will be ſeen, that no received theories will account for the phenomena,—that granite has undergone at leaſt one revolution, and that the ſtrata of pudding and ſandſtone have undergone not leſs than three revolutions, of decompoſition, and recompoſition, before they were brought into the ſtate in which we now find them.

CON-

CONTENTS.

	Page.
Name - - - - - - - -	1
Situation and Extent - - - -	2
Political State - - - - -	4
Ecclesiastical State - - -	7
Population - - - - -	10
History - - - - -	16
SOILS AND MINERALS - - - - - -	35
Arran Castle, Goatfell, &c. - - -	36
Glen Rosa, Shirreg, &c. - - -	49
Glencloy, Glendow, &c. - - -	59
Promontory between Broddick Bay and Lamlash - - - - -	63
Island of Lamlash, Bay, &c. - - -	80
Vale of Lamlash, &c. - - - -	90
Promontory between Lamlash and Whiting Bay	99
From the Dipping to the Struey Rocks -	106
Struey Rocks, &c. - - - -	121
South End - - - - -	129
Vale of Shiskin, Machry, &c. - -	161
From Machry to Glen Iorsa - -	181
From the River Iorsa to Loch Ransa -	185
Glen Ransa - - - - -	194
From Loch Ransa to Glen Sannox -	206

Currie,

	Page.
C[illegible] &c. - - - -	225
Sea-beach to Arran Castle - -	234
DESCRIPTION OF THE STRATA MENTIONED AND REFERRED TO IN THE PRECEDING SURVEY BY DR WALKER - - - -	237
Sandstone - - - -	240
Red Ferruginous Clay, or Shiver -	242
Molaris and Breccia - - -	243
Stomoma - - - - -	244
Blotta, Primary Breccia, or Puddingstone -	245
Grey Granite - - - -	246
Micaceous Schistus - - -	248
Rubble, or Bastard Freestone, -	249
Wacken Porphyry - - -	250
Syenite - - - - - -	251
Basaltic Columns - - - -	253
Fatiscent Whinstone - - -	256
Whinstone, or Basalt - - -	257
Porphyry - - - - -	259
Slate, Steganium - - - -	261
Ardesia - - - - - -	263
GENERAL REMARKS.	
I. On the Granite Mountains, Topazes, &c.	265
II. On Micaceous Schistus, or Lepidotes	272
III. On the Breccia, or Puddingstone, Sandstone, &c. - - - -	279
IV. On Ironstone, Potter's Clay -	286
V. On Pitchstone - - - - -	287
VI. On Basalt, Porphyry, &c. -	288
AGRICULTURE.	
Arable Surface - - - -	305
State of Property - - - -	307

Mode

	Page.
Mode of Occupancy - - -	309
Farm Offices - - - -	312
Implements of Husbandry - -	315
Live Stock. Horses - - -	318
Cows - - - -	320
Sheep - - - - -	322
Game - - - - -	324
Reptiles - - - -	327
Course of Cropping - - - -	329
Mills - - - - -	334
Hints of Improvements - - -	336
Manures - - - -	342
Analysis of Limestone - - -	343
Roads - - - -	346
Woods and Plantations - - -	348
Climate - - - -	349
Temperature of Arran, 1803 - -	353
MANUFACTURES.	
Kelp - - - - -	355
Iron, &c. - - - - -	360
Wool, Lint - - - -	361
FISHERIES - - - - -	363
ON OSSIAN'S POEMS - - - - -	395

V I E W

OF THE

MINERALOGY, AGRICULTURE, MANUFACTURES, FISHERIES, &c. &c.

OF THE

ISLAND OF ARRAN.

NAME.

Persons ſkilled in the Gaëlic derive the word *Arran* from various ſources. The late Reverend John Hamilton (Statiſtical Account, vol. IX. p. 165.) derives the name from a battle fought by Fingal, againſt a ſon of a king of Norway, on the north of the iſland, in which the Norwegians were all ſlain. Hence he compounds the name of *Ar-fhin*, the ſlaughter of Fin, or Fingal. I found this etymology to correſpond with the popular traditions.

But the late Rev. Gerſham Stewart, (vol. VIII. p. 578.), with more probability, derives the name from *Ar*, high, and *In*, iſland.

In Gaëlic, *Arran* means bread; and some derive the name from the natural fertility of the district on the south end of the island.

SITUATION AND EXTENT.

This island is situated near the mouth of the Frith of Clyde, having the mouth of Lochfine towards the north; in one place, distant from Kintyre, on the west, only five or six miles; its nearest point to Campbelton in Kintire being about twelve miles; its nearest point to the island of Bute, on the north-east, may also be about twelve miles; its nearest point to the new harbour of Ardrossan, on the east, may be about fifteen miles; and from Broddick Bay, or Lamlash, to the same harbour, or to Saltcoats, may be about twenty miles. Thus, this island is situated much nearer to the coast of Argyle than of Airshire; and it may be considered as a link in the great chain of the Grampians from Aberdeen on the north-east. The stupendous rock of Ailsa, situated about thirty miles to the south of Arran, may be considered as another link in this chain. I have been told this rock is mostly composed of granite; and from it the chain is continued through the mountainous parts of Carrick, until it terminates at the Mull of Galloway.

The greatest length of this island, from north-east to south-west, may be about thirty-four or thirty-

thirty-five miles; its breadth varying from about fifteen to twenty miles. But as no geometrical furvey has been made of it, thefe dimenfions are only deduced from conjecture. *

* The natives reckon the ifland twenty-four miles long; but two of their computed miles are hardly fhort of three Englifh.

POLITICAL STATE.

This iſland, together with Bute, forms a county under the name of the latter; of which Rothſay in Bute is the capital. In conſequence of the Union, this county was claſſed with Caithneſs, in the north of Scotland, in returning a repreſentative to Parliament. The two counties return a repreſentative *per vices*, ſo that one of them is always unrepreſented.

As Caithneſs is rapidly advancing in improvement and importance, a propoſal has been entertained there to apply for a conſtant repreſentation of that county. But it is difficult to ſee how this can be done, without unhinging the Union.

It is curious to obſerve the different aſpects in which people, at different periods of ſociety, view political inſtitutions. It is certain that Parliaments were not originally an invention of the people, but of our kings, who had no other means of getting their power recognized, except in a numerous aſſembly. Our kings never acquired ſtrength ſufficient to keep in order their ruffian nobles; and though they often procured the enactment of wiſe and ſalutary laws, they knew theſe laws could not be executed without the concurrence of all the leading

leading men in the community. At firſt, every freeholder was bound to perſonal attendance, which was regarded by moſt of them as an intolerable grievance. Even the idea of repreſentation, which never occurred to the Greeks and Romans, was not an invention of the people, but of the kings. Being perpetually haraſſed with petitions from the ſmaller barons, claiming exemption on account of poverty, or other cauſes, they propoſed that all the freeholders of a diſtrict ſhould unite in chooſing a perſon to act for them, and pay him for his trouble. Thus, a diſtinction was gradually eſtabliſhed between the *greater* and *leſſer barons*;—or rather thoſe who continued to give perſonal attendance, and thoſe who concurred in chooſing a repreſentative.

Even after repreſentation was introduced, we find ſeveral towns and counties in Scotland pleading poverty, and inability to pay a repreſentative his neceſſary expenſes, and on theſe grounds claiming an exemption. It was from repreſentations of this ſort that the county of Caithneſs was claſſed with that of Bute, in the Union Parliament.

Little were our ancient kings aware, that an aſſembly, which they regarded as the evidence and organ of their power, and in which they were ſo earneſt to force a numerous attendance, by penalties and other means of compulſion, would in time become a formidable check upon them. Nor

were the people aware, that the office of reprefentative, which they could hardly get perfons to undertake for a liberal hire, would come not only to be difcharged for nothing, but would even become an object of violent competition, and often afpired to through bribery.

The Duke of Hamilton's factor is a juftice of the peace, and baron-baillie within the ifland of Arran. From his decifions an appeal lies to the Sheriff of Bute at Rothfay. He may imprifon a delinquent during forty-eight hours in Arran caftle, until he can be fent to the county jail at Rothfay. Few crimes are committed; and capital offences are never heard of. The county is under the jurifdiction of the Circuit Court of Jufticiary at Inverary, in which all capital cafes are difcuffed; and appeals, in civil cafes, are decided by a Jury. The Sheriffs of our counties generally wave their jurifdiction in capital cafes; becaufe their decifions are not final, but fubject to the review of the High Court of Jufticiary.

ECCLE-

ECCLESIASTICAL STATE.

The island contains two very extensive parishes, those of Kilbride and Kilmorie. The first comprehends all the east and north-east sides of the island; the second the south, west, and north-west sides. The ministers have 120l. a year each, exclusive of manses and glebes. These parishes make part of the presbytery of Kintire, and of the synod of Argyle; which includes all the extent formerly under the ecclesiastical jurisdiction of the Bishops of the Isles.

The parish of Kilmorie has a separate place of worship in the mouth of Clachan Burn, near Schiskin, where the minister occasionally officiates. Another place of worship was established at Loch-Ransa, by Ann, Dutchess of Hamilton, and a salary mortified to maintain a preacher there, which, though sufficient at that time, is now very inadequate. It would be of great use to the people to have an ordained clergyman, with a more ample endowment, settled at Loch Ransa.

The people are remarkably pious and devout, without shewing any predilection for wild and extravagant notions of religion. Each parish has an

eſtabliſhed ſchoolmaſter, agreeable to the law of Scotland; and there were formerly two or three ſchools eſtabliſhed by the Society for Propagating Chriſtian knowledge, but were withdrawn, from want of the requiſite accommodations; which is much to be regretted.

The Chriſtian faith ſeems firſt to have been planted in this iſland by St Molios, who was a diſciple of the celebrated St Colm, or Columba, the apoſtle of the Highlands and Iſles. One cannot read the hiſtory of this Saint, as edited by Mr Pinkerton, and more fully illuſtrated by Dr Smith of Campbelton, without being impreſſed with a belief that his conduct was not altogether ſuitable to his profeſſion, or to the tranſcendent talents with which he was endowed. Though we have only the teſtimony of an admiring diſciple, who would naturally endeavour to keep out of view every thing unfavourable to his character, yet even his narrative excites a ſuſpicion that he murdered Oran, on account of ſome unhappy difference in religious opinion. His zeal againſt women, whom he would not allow to enter his ſacred iſland, is alſo liable to ſuſpicion; when it is certain that, in his days, marriage was not conſidered as inconſiſtent with the character of a clergyman. Though he baniſhed women from his ſacred iſland, he ſeems to have kept a ſeraglio of them on a ſmall iſland adjacent, under the de-

ſignation

ſignation of a Nunnery. After he became old, he allowed his women to come to him, in his ſacred iſland, to ſave himſelf the trouble of going to them.

The traditions in Arran ſtate, that Molios, diſguſted with the irregularities of his maſter, withdrew himſelf from his ſociety, and, wiſhing to ſupport that auſterity of manners, which, though not abſolutely required in every profeſſor of Chriſtianity, he deemed indiſpenſably neceſſary in one who undertook the office of a miſſionary to convert the heathen, took up his reſidence in a cave in the iſland of Lamlaſh, from him called Holy Iſland. It appears that, after he had made numerous converts in Arran, he removed to the diſtrict of Schiſkin, where he died at the advanced age of 120.

POPU-

POPULATION.

In a country where the exifting population fluctuates fo much, it is difficult to afcertain the average permanent population. The caufes of fluctuation fhall afterwards be accounted for. In the mean while, it is proper to ftate all the afcertained facts.

From the Statiftical Account (Vol. VIII. p. 581.), it appears there were in the parifh of Kilbride,

(1793) - - -	2545 fouls.
The return to Dr Webfter in (1755) was - - -	1369
Increafe	1176

From Vol. IX. p. 170, it appears there were

in Kilmory - - - -	3259 fouls.
Return to Dr Webfter -	2277
Increafe	982
Total in 1793 - -	5804
Total in 1755 - -	3646
Total increafe from 1755 to 1793,	2158

The population of Arran was again afcertained in 1801, agreeable to act of Parliament; and the name

name of every man, woman, and child, then refiding in the ifland, is recorded in a book, drawn up by Mr Stevenfon, factor to the Duke of Hamilton, in his own handwriting: of which the general refult is, that there were then in the parifh of

	Males.	*Females.*	*Total.*
Kilbride	1008	1175	2183
Kilmory	1369	1627	2996
Total	2377	2802	5179

Total decreafe from 1793 to 1801 625

Neither in Dr Webfter's, nor in the Statiftical Account, is there any difcrimination between males and females. But in Mr Stevenfon's account they are accurately diftinguifhed, and their names and ages inferted in feparate columns, and fummed up at the bottom of each page; of which I could only give the general refult. From his ftatement, it appears that, in the parifh of Kilbride, the females exceeded the males by 167; while, in the parifh of Kilmory, the females exceeded the males by 258. Hence, the excefs of females over males, in the whole ifland, is 425.

From all the regiftrations of baptifms I have perufed, which are never accurate, it appears there are rather more males born in our country, than females. How, then, fhall we account for 425 females

females exiſting in the iſland of Arran, without help-mates."

Many of the young men go to ſea. Some never return; and thoſe who do return, are never all aſſembled on the iſland at the ſame time. Hence, every enumeration of the males muſt fluctuate, and the number of females muſt always exceed that of males.

On the 6th and 7th of October 1803, the Depute-Lieutenants of the county found on the iſland 1500 men able to carry arms; and about 500 men liable to ſerve in the Militia and Army of Reſerve. But ſuch is the averſion of the people here to the land ſervice, that they choſe to pay the penalty; and only one or two could be prevailed upon to enter into the militia. The late Duke of Hamilton was ſo much beloved among them, on account of his kind condeſcenſion and extenſive charities, that few of them ſpeak of him with dry eyes. Yet, when he propoſed to raiſe a regiment, he was able to prevail only on a very ſmall number of them to join his colours; and theſe were enticed by extravagant bounties. Had he propoſed to man a ſhip of the line, the people would have riſen in maſs.

The people have no other averſion to the naval ſervice, than what is common to other ſeamen, viz. the ſuperior wages given by merchants during war. Though not remarkable for gigantic ſtature, they are athletic and well ſhaped; and, in our

ſhips

ſhips of war, are diſtinguiſhed by prompt obedience, and orderly conduct.

This bent towards a ſeafaring life is not peculiar to the people of Arran; but is common to the inhabitants of all the iſlands and highlands that are contiguous to the ſea. It marks the importance of putting the fiſheries into a proper train of improvement.

I could not learn that the people here have any ſuperſtitions that are peculiar to them. The ſecond ſight has ſo long ceaſed to be known, that it now ſeems to be entirely forgotten. They ſeem ſtill to entertain a faint belief in faires, witches, and ghoſts; though even theſe ſeem to be rapidly falling into oblivion. Among the old men, there are numerous traditionary ſtories concerning Fion and his heroes; though the poems have ceaſed to be repeated.

Mr Pennant (Tour to the Hebrides, Vol. II. p. 200.) ſays, the people in Arran bleed, with the utmoſt regularity, at ſpring and fall. That, at theſe ſeaſons, the ſurgeon makes a tour of the iſland. 'On notice of his approach, the inhabi-'tants of each farm aſſemble in the open air, ex-'tend their arms, and are bled into a hole made 'in the ground, the common receptacle of the 'vital fluid.'

I was well informed, that this ſtory was told

Mr

Mr Pennant in the way of joke; and that no ſuch practice was ever known in Arran.

So far from the health of the people being treated in this butcher-like manner, the Dutcheſs of Hamilton eſtabliſhed a ſalary to induce an able medical man to reſide in the iſland. That office has always been ably filled; and by no one more ſo than by Mr Stoddart their preſent ſurgeon.

The ſmall-pox only viſit the iſland at diſtant intervals, being brought by people from the Main-land, and prove very fatal. Dr Stoddart has made ſeveral attempts to introduce the vaccine inoculation; but the matter, which was ſent from Edinburgh, had loſt its power, and did not take effect. Other diſeaſes are few, and no way peculiar in their mode of operating.

Though moſt of the people underſtand Engliſh, many of them are baſhful, and averſe to ſpeak it. The Gaëlic appears to be a pictureſque language, and to come home to their imaginations and feelings. But, in order to ſpread the knowledge of improvement, it would be deſireable to have only one language. For this purpoſe, the clergy ſhould gradually diſcontinue their diſcourſes in Gaëlic; and the ſchoolmaſters ſhould exert all their efforts to inſtruct the youth in a knowledge of Engliſh. This recommendation I would apply to the whole Highlands and Iſles. Let us be one people, having

ing one language, the fame laws, and fimilar cuftoms. In this way, and this alone, the power and profperity of thefe kingdoms may be carried to an extent far beyond what they have yet attained.

MIS-

HISTORY.

The Gaël, a tribe of the Celts, feem to have inhabited the Highlands and Hebrides, from time immemorial. All our hiftorians err in fuppofing, that the kingdom of Scotland had been united under one chief or monarch, from the earlieft times, fuch as took place at the times they wrote. So far from this being the cafe, it appears evident, that the country long groaned under the tyranny of petty chieftains in every diftrict; and that though a fupreme chief came ultimately to be acknowledged, he never acquired power fufficient to maintain peace in the country, until the acceffion of our monarchs to the Englifh throne.

From the numerous names of places in all parts of Scotland, evidently of Gaëlic extraction, it appears that this people, at one time, inhabited the whole kingdom; and, it is probable, the whole ifland. Many theories have been advanced to account for the original peopling of the Britifh ifles; but as they all fuppofe a knowledge of naval architecture, and of navigation, which certainly was not attained at the periods to which thefe theories refer, they feem entitled to no fort of credit.

The

The moſt natural ſuppoſition is, that the original inhabitants of Britain came from the oppoſite coaſts of France; perhaps at a very early period, before the ſea was interpoſed between Dover and Calais. Swarm following ſwarm, and living by hunting, they would ſoon traverſe the whole iſland, and not aſſume permanent habitations, until they found their progreſs checked by the ocean.

Our old hiſtorians bring the Gaël from Egypt, or Troy. After landing them in Gallicia in Spain, where they perform a competent number of adventures, they bring them to Ireland; where, having encountered a ſufficient quantity of battles and dangers, they land them on the coaſt of Argyle; there, getting in contact, firſt with the Picts, and afterwards with the Romans, they finally prevail in expelling the one, and ſubduing the other.

To me it appears that the Picts were not a diſtinct people from the Gaël; but tribes which lay contiguous to the Roman ſtations. The practice of tattooing and painting their bodies, is common to all rude nations; and the Roman writers uniformly diſtinguiſh the inhabitants of Britain by the appellation of *picti Britanni*. As far as their conqueſts extended, they laboured to diſcourage this practice, and to introduce the Roman dreſs, manners, and arts. This occaſioned a new diſtinction between the *picti* and *non picti Britanni*. The *picti* was uſed as a term of reproach, denot-

ing barbarifm, and incivilization. But what paffed as a term of the higheft contempt among the tribes which had fubmitted to the Roman yoke, was affumed as a title of honour, denoting national independency, and adherence to ancient ufages, by the tribes which continued to refift the Roman power. It is certain that no tribe in Britain affumed the name of Picts, until the Roman conquefts met with an effectual refiftance in the north; though it is equally certain that all the people indulged themfelves in this practice, before the arrival of the Romans. In the vulgar dialect of Scotland, *pic* denotes paint; and *pecht*, or *pechted*, denote a thing painted at this day. Thefe words are evidently derived from the Latin.

After the Romans got poffeffion of a great part of the low country of Scotland, they called the country which ftill continued to refift them *Caledonia.* This is, evidently, a Latin termination clapped to a word ftill ufed in the Highlands—*Gaël-dūn*—which denotes the Gaël of the mountains, when diftinguifhed from the Gaël of the vallies; or, as the diftinction has been long known in Scotland, between Highlanders and Lowlanders. The letter G in Gaëlic is pronounced fo like C or K, that the Roman fpelling can be eafily accounted for.

It appears from this term, that there were then Gaël of the vallies, as well as Gaël of the mountains,

mountains, else the term never would have been used.

Within my own remembrance, the Gaëlic language extended, in many places, far beyond the barrier of the Grampians. Now, it is not used nor understood on this side of the Grampians; and in all points where improvements have penetrated these mountains, the Gaëlic has ceased to be known.

As the term *Pick*, or *Pict*, first became a national name, from being used as a term of reproach, so the name *Scot*, or *Scuit*, seems to be derived from the same origin. Of this name we hear nothing until towards the decline of the Roman power in Britain. It means a wanderer, one who lives by rapine, or, more correctly, what we would call a highwayman. It seems to have been applied, by the provincial Britons, as a term of reproach, to those northern tribes, who made incessant irruptions into the territories subjected to the Romans, and who carried among them havock and devastation. But it often happens, that what is meant as a reproach by one party, is assumed as a title of honour by their opponents. In later times, we have an example of the word *Scot* becoming the cognomen of a gang of Border thieves. It was evidently first applied to them as a term of reproach; but afterwards assumed by themselves as a title of honour.

The Gaël never heard of the word Scot, nor do they diftinguifh themfelves, or their country, by that name. They call themfelves Gaël Albinich, *Gaels of Albion*; which latter feems to have been the original name of the Britifh Ifland. Nor have they the flighteft veftige of tradition among them, which points at an Irifh extraction. On the contrary, they believe that the Celts of Ireland, whom they acknowledge to be the fame people, having the fame language and manners with themfelves, derived their origin from them. It appears certain that the Celts in Ireland, and thofe on the oppofite coafts of Scotland, during feveral ages, were united in the clofeft bonds of alliance, and that they maintained a friendly intercourfe with each other. This intimacy feems to have been excited, firft, by the attacks of the Belgæ upon the Irifh; fecondly, by the attacks of the Norwegians and other northern hordes upon both; and, laftly, by the attacks of the Englifh.

Thefe circumftances induce a belief that the original Picts were tribes of the Gaël: That the progrefs of the Roman conquefts towards the north, firft fuggefted the neceffity of tribes, independent before, or united by very feeble ties, fubmitting to a common chief, in order to repel the common danger: That this paved the way for the eftablifhment of two monarchies, after the abforption of feveral fubordinate monarchies; the one of

of the Picts on the east of Scotland; the other of the Caledonians, afterwards Scots, on the west.

But, without prying into the recesses of antiquity, where we have nothing to bear us out but uncertain traditions, obsolete monuments, and old usages, which are now rapidly falling into oblivion; we conceive it will be admitted by all, that the Gaël of the Highlands and Isles, have occupied their present settlements from time immemorial.

It seems therefore only necessary, as far as the island of Arran is concerned, to glance at the principal events which affected the islands in general, and this one in particular.

From Dr Barry's history of the Orkneys, we learn, that Harold Harfager, king of Norway, A. D. 870, attacked the Shetland and Orkney islands with a powerful fleet and army. That he utterly extirpated the Peti and Papæ, who seem to have been Picts, and their priests, who then inhabited these islands, and planted them with Norwegian colonies. He then advanced against the Hebudæ or Hebrides, all of which he subdued, including the Isle of Mann; but does not seem to have extirpated the inhabitants. Our historians add, that in the treaty by which the King of Scots ceded these possessions, Harold inserted a clause, that he should have all that could be surrounded by boats. Taking advantage of this clause, he caused himself

to be carried in a boat, with great pomp, across the narrow isthmus called Tarbet, by which he claimed the peninsula of Kintyre as part of the ceded territory.

In 920, he conferred the government of all his conquests on Sigurd the elder, whom he created Karl, or Earl, of Orkney.

This constituted a sovereignty to all practical purposes independent, and rather the ally, than the vassal, of Norway, or afterwards of Denmark. At its greatest exaltation, the Earls of Orkney possessed the Shetland and Orkney isles; the three northern counties of Scotland; all the Hebudæ, including the isle of Mann; with several territories on the west of Invernefs and Argyleshires. At the same time, they possessed extensive territories in Ireland. When this sovereignty was united under an enterprizing leader, it was very formidable to the south of Europe. Their undisputed naval superiority, joined to the desperate valour of the people, at a time when success in fighting depended more on individual skill and courage, than on the scientific tactics of their leaders, made the greatest monarchs tremble on their thrones. These islands were the rendezvous of all those pyratical expeditions, which, during several centuries, infested the south of Europe. They also furnished abundance of recruits for every daring enterprize. The alliance of the Earls of Orkney

was

was eagerly courted by the greatest sovereigns, and their forbearance bribed by the most munificent presents.

But this sovereignty contained within itself the seeds of its dissolution. Males succeeded *in capita*; and when there was more than one son, their strength was wasted in contests, often bloody, about the division of the inheritance. Even females, or their husbands and children, were considered as having an equal right of succession with their brothers. When the inheritance terminated in females, their husbands transmitted to their children a perpetual dismemberment of the sovereignty, which could not be resumed by the chief of the family, until the race of the former became extinct. Had they kept the sovereignty indivisible, while they divided only property or effects, such was the situation of the times, that they might have conquered a great part of the south of Europe. They did establish several permanent conquests, while their depredations kept all Europe in alarm. But the causes of division specified, prevented them from doing half the mischief they otherwise might have done.

The Hebudæ were finally dismembered from the earldom of Orkney, in consequence of a division of the territories among three females. The one who received the Hebudæ as her portion, married a Scottish nobleman; and though her

successors acknowledged a nominal subjection to the king of Norway, they were more immediately connected with, and owned subjection to, the king of Scots, for their possessions on the Mainland.

It appears that the same rules of succession, and the same feuds and animosities, which had so often distracted the earldom of Orkney, prevailed in this new principality. But as they had no other historians but their Bards, or Shenachies, their transactions have long fallen into oblivion; nor do they seem to have been of sufficient importance to deserve remembrance.

In the thirteenth century, Alexander III. king of Scotland, claimed the Hebrides as an ancient appanage of his crown, which had been wrested from his predecessors by naval power. This produced a war between him and Haco, or Hacon IV. king of Norway. Haco assembled his forces in the island of Arran, 1256; from whence, debarking on the opposite coast of Ayrshire, he laid waste the country with fire and sword, while his fleet advanced along the Frith of Clyde to Largs. Alexander met his forces, encumbered with spoil, near Kilburnie in Ayrshire, endeavouring to retreat on board their ships. He pursued them, with great slaughter, to Largs. Torfæus, who accompanied Haco in this expedition, claims the victory to his own party. But the testimony of the Scottish historians is confirmed by the event. Haco, with

with the ſhattered remains of his forces, returned to Kirkwall in Orkney, where he died of a broken heart. His ſucceſſor, Magnus V, perceiving his inability to defend theſe iſlands againſt the enterprizes of Alexander, ceded them by treaty, in 1266, on condition of his paying the annual ſum of one hundred marks. This is what our hiſtorians call the ‘ Annual of Norway,’ which, though often claimed, ſeems to have been paid very irregularly, if paid at all.

Thus, theſe iſlands, after having been from 870 to 1266, disjoined, were reunited to the crown of Scotland. But their ſubjection was rather nominal than real; for their chiefs, who acquired the title of Lords of the Iſles, acted rather as independent ſovereigns than as vaſſals or ſubjects.

The Norwegian conquerors ſeem to have incorporated themſelves with the Gaël, while they poſſeſſed theſe iſlands, and to have adopted their language and cuſtoms. The only memorials they have left in theſe iſlands, are names of places from the Norſe language, and a few of their words adopted into the Gaëlic. They have alſo left many ruins of rude forts.

In progreſs of time, the Lords of the Iſles came to be diſtinguiſhed by the cognomen of Macdonnel. They often made war upon the kings of Scotland, and treaties of alliance with their enemies. When Edward I. of England advanced his

claim

claim to the throne of Scotland, he found it necessary to attach the Lord of the Isles to his interests, by treaty, and by giving him his sister in marriage. The power of these chieftains became less formidable, after they were stripped of the earldom of Ross, and other ample possessions on the Mainland. But the islands were not reduced under complete obedience to the Scotish crown, until James V. made a progress through them.

The annual of Norway had been often demanded, but evaded, or very irregularly paid, until the arrears, with the penalties for failure of payment, amounted to a very considerable sum. At last Christiern, who possessed the united crowns of Norway, Sweden and Denmark, granted a discharge of all these claims, and superadded the islands of Orkney and Shetland, as a portion with his daughter Margaret, married to James III. of Scotland, 1469. Thus were all the islands contiguous to Scotland irrevocably reannexed to that crown, after they had been under the dominion of the northern nations during several centuries.

There is one subject of remark, and of regret, that these islands do not seem to have enjoyed so great a comparative degree of prosperity, since they were annexed to the Scotish crown, as they did while they were independent. The fisheries are an inexhaustible source of wealth and population, thrown around them by the hand of Nature.

Though

Though ſeveral of our kings proſecuted the improvement of the fiſheries with great ardour, and no inconſiderable ſucceſs, they were too often in captivity, or minors, to allow time for any plans to operate their full effect.

Having hinted at the principal occurrences which affected the iſlands in general, we ſhall preſent a few ſhort notices connected with the Iſland of Arran in particular.

The circumſtances reſpecting the reſidence of King Robert Bruce in Arran, as far as they can be collected, are as follow.

This hero had aſcended the throne of his anceſtors at Scone, 27th March 1306. The Counteſs of Buchan, ſiſter to the Earl of Fyfe, in the abſence of her brother, claiming an ancient privilege of her family, actually placed the crown upon his head.

But the ſmall party which adhered to Bruce was ſoon routed and diſperſed, by the Engliſh forces ſtationed at Perth. Bruce, with the diſpirited remains of his party, retired into the wilds of Athole. He afterwards made an irruption into Aberdeenſhire, where he met his wife, and the wives and female relatives of his followers, all determined to ſhare the fortunes of their huſbands, their fathers, and brothers. At the approach of the Engliſh, they again ſought refuge among the mountains, and, accompanied by their faithful women,

women, reached Breadalbine. They were attacked and defeated by Alexander of Argyle, the Lord of Lorn, who had married the aunt of Comyn, and was eager to revenge the ſlaughter of that chief. Bruce covered the retreat of his ſmall party, and checked the purſuit of his enemies. They had hitherto ſubſiſted by hunting and fiſhing; but winter approaching, Bruce ſent his queen, and the other ladies, with all his horſemen, to the caſtle of Kildrummie in Marre: himſelf, with two hundred men, reſolved to force a paſſage into Kintyre, and from thence to croſs into the northern parts of Ireland.

After encountering incredible hardſhips, and being often reduced to the laſt extremity of famine, Bruce, with a few faithful companions, reached Rachrin, an iſland on the northern coaſt of Ireland. Here he remained during the winter; and his enemies ſeem to have imagined him to be either dead, or ſo completely humbled, that he was no longer formidable.

At the approach of ſpring, however, he ſecretly paſſed over into the Iſland of Arran. He is ſuppoſed to have landed at King's Cove, and to have reſided there, ſubſiſting by hunting and fiſhing, until he could ſound the inclinations of the natives towards his cauſe.

How long he remained here is uncertain; but it is a fact that ſeveral natives of the iſland afterwards

wards obtained from him grants of lands, for services they had rendered to him while here, or, while they followed his fortunes.

The learned and accurate Lord Hailes, in his Annals of Scotland, relates the manner of his escape from Arran rather differently from popular tradition. Tradition says, that the king himself went over, in a small boat, to the opposite shore of Carrick, to sound the dispositions of the people, and to rouse the vassals of his house. That in the disguise of a minstrel, he insinuated himself into the good graces of the English forces, who occupied the castle of Turnberry, and places adjacent, and found they might easily be surprised; but his vassals had lost all hope of effectual resistance. He had agreed, if he found matters favourable, to cause a fire to be lighted on a certain hill opposite to Arran, which was to be the signal for his followers to pass over to him. But it happened that some boys had raised a blaze of peas, a practice formerly very common in Scotland, near the place agreed on, which brought over his men from Arran. The king met them on the coast of Carrick, explained the cause that had misled them, and informed them that his fortunes were utterly desperate.

Lord Hailes says, that Bruce sent a confidential messenger to sound the dispositions of his vassals, with instructions, if he found them favourable, to make

make a signal on a day appointed, by lighting a fire on an eminence above the castle of Turnberry.

'The messenger found the English in posses-'sion of Carrick; Percy, with a numerous garri-'son at Turnberry; the country dispirited, and 'in thraldom; none to espouse the party of Bruce, 'and many whose inclinations were hostile.'

On the day appointed, Bruce anxiously watched the expected signal. In the afternoon he saw the welcome fire, and immediately embarked with his followers. Night surprised them on the sea; but, conducting themselves by the fire, they reached the shore. Here they met the messenger, who reported there was no hope of aid. 'Traitor!' cried Bruce, 'why did you make the signal?' 'I made no signal,' replied he; 'but observing 'a fire on the eminence, I feared it might deceive 'you, and I hasted hither to warn you from the 'coast.'

If there be any truth in the tradition, that the fire was occasioned by burning peas in the straw, it will serve to mark the period of the king's residence in Arran. It is probable he came there about the beginning of March, and passed over to Carrick about the close of harvest. As the nights would now be getting long, with frequent fogs, this season would be the most favourable of any for surprising his enemies with a handful of men.

Bruce

Bruce now ſaw he could not return without being obſerved, and the place of his retreat diſcovered. He therefore reſolved to obey the dictates of valour and deſpair, and to perſevere in his enterprize.

Never was enterprize undertaken in ſuch hopeleſs circumſtances. Moſt of the ſtrong holds of Scotland were garriſoned by Engliſh troops. The greateſt part of thoſe who had declared for him at his coronation had been impriſoned, or executed as traitors. His wife had been betrayed into the hands of Edward; and the heroic Counteſs of Buchan, who placed the crown upon his head, was exhibited in a cage at Berwick, a ſpectacle of deriſion to the populace. The nobles had ſworn fealty to Edward, acknowledged his right to the crown of Scotland, and were moſtly ranged under his banners. Thoſe who had ſhewn a partiality for Bruce had been forfeited, and their lands conferred upon Engliſh ſettlers. The numerous adherents of John Comyn entertained a perſonal hatred againſt Bruce, and were zealous to revenge the death of their chief. The party of Baliol, though numerous, had loſt much of their attachment to him, on account of his puſillanimous reſignation of his rights to the Engliſh monarch; yet they were all profeſſed friends of Edward, and enemies of Bruce. The pope, too, whoſe curſes in thoſe days were more formidable than embat-

tled

tled armies, at the instigation of Edward, had solemnly excommunicated Bruce, and all who adhered to him, for the slaughter of John Comyn in a church.

Though fortune still continued to persecute Bruce, yet, by heroic courage and perseverance, he ultimately succeeded, and, by the battle of Bannockburn, established the independence of his country. He did more. By wise and salutary laws he civilized, and by a vigorous administration he promoted the prosperity of that country which he had rescued from oppression.

At a subsequent period, the Lord Boyd, abusing the influence he had acquired during the minority of James III. caused his son Sir Thomas Boyd to be married to the king's eldest sister, 1467. This lady had been affianced, during her infancy, to the son of Henry VI. of England; and she is said to have been afterwards promised to the Lord Hamilton. Boyd caused Arran and other lands to be erected into an earldom, and conferred as a marriage-portion with the lady. On the fall of the Boyds, this princess was so much attached to her husband, that she fled with him to Denmark. Her brother contrived to fetch her home, and caused her to be divorced from Boyd. She was afterwards married to the Lord Hamilton, 1474; but seems not to have consented to this match, until she heard of her first husband's death.

By

By this marriage the Hamilton family acquired the earldom of Arran; and, during the minority of Mary, became next in fucceffion to the crown of Scotland.

From Douglas's Peerage, p. 326, we learn that the Hamilton family are defcended from the Earls of Mellant, a great and noble family in Normandy; that they came over with William the Conqueror, to whom they were nearly related; and, for great fervices in the battle of Haftings, were by him rewarded with many ample poffeffions, and became Earls of Leicefter in England. They derived the name of Hamilton from the manor of Hambleton in Buckinghamfhire, where they chiefly refided. They firft came to Scotland, 1215, in the reign of Alexander II., who conferred many favours upon William, third fon of Robert, the third Earl of Leicefter. From Malcolm Kenmore downwards, it was the invariable policy of our kings to encourage people from more civilized countries to fettle in Scotland. When England was convulfed by civil wars, the lofing party always found an afylum and protection in Scotland. From this policy, the language and manners of great part of the country were gradually changed; and many of our greateft chiefs, fuch as the Hamiltons, the Gordons, the Sinclairs, the Frafers, &c. &c. are either of Saxon or of Norman extraction. The illuftrious King Robert Bruce con-

ferred the barony of Cadzow (afterwards called Hamilton), and many other poffeffions, on Sir Walter de Hambleton, for heroic fervices in his wars with the Englifh. The family continued in great favour with fucceeding monarchs, until they became princes of the blood, and heirs apparent to the crown of Scotland; as already narrated.

Having prefented thefe fhort hiftorical gleanings relative to Arran, it only remains to be mentioned, that fuch monuments of antiquity as occur, fhall be defcribed in the progrefs of the enfuing Geological Survey.

SOILS

SOILS AND MINERALS.

These are claſſed together, becauſe ſoils are formed from the decompoſition of rocks, and contain a greater or ſmaller proportion of animal and vegetable matters mixed with the mineral ſubſtances which have been worn from the rocks. Soils are either primary, or ſecondary. The primary ſoils cover the rocks, from whoſe decompoſition they have been formed; and their fertility commonly depends on their degree of depth, the proportion of animal and vegetable matters, or the quality of the rocks whoſe decompoſition forms their baſis. The ſecondary, or alluvial, ſoils, have been conveyed into their preſent ſituation by water. They commonly contain a greater proportion of vegetable matter; and unleſs where they are chiefly compoſed of ſand or rounded ſtones, are commonly more fertile than the primary ſoils. But this depends much on the quality of the rocks from which the alluvial ſoils have been waſhed: for primary ſoils on whinſtone rocks, which often contain portions of carbonate of lime and of iron; and ſoils on limeſtone rocks, not overcharged with carbonate of lime, are often more fertile than al-

luvial foils. The moft frequent defect of thofe foils is want of fufficient depth.

ARRAN CASTLE, GOATFELL *, &c.

Arran Caftle is fituated on a rocky bank, which rifes from the north fide of the Bay of Broddick. This bank is part of a peninfular elevation, or fhoulder, projected from the bafe of Goatfell.

The original part of the caftle confifts of a large, high and maffy quadrangular tower, whofe internal accommodation, and external gloom, lead the mind to reflect on thofe diforderly times, when a baron, though immured within battlements that feemed impregnable, feldom clofed his eyes at night without apprehenfion that his throat might be cut before morning. From this tower certain buildings have been detached towards the weft, which, though ancient, are of a more recent date. The late Dutchefs Ann built a modern houfe on the fouth fide of the caftle, and did much to improve the accommodation of all the buildings connected with it.

On

* The Gaelic name of this mountain is *Gaodh Bhein*, *mountain of winds*; and the name *Goatfell* has been impofed on it by the *Saffanoch*, or ftrangers, who have vifited the ifland. There is a grofs abfurdity in calling it *Goatfield*; the laft fyllable denoting a level plain, to which it is a complete contraft.

On the south side of the castle, a large square area is surrounded with a high and very thick wall, ruinous in several places. This wall is faced with a parapet, having embrazures for wall-guns, or other projecting engines; and includes all the stables and out-houses of the castle.

To the north side of the castle, Oliver Cromwell added an angular bastion. It consists of an elevated bank of earth, included within walls of great thickness and strength, and paved above with massy hewn flags, sloping so as to throw off water like the roof of a house. Above these flags a high parapet rises, having three embrazures towards the bay, and three towards the country; so that their artillery might either prevent landing in the bay, or scour the country.

In this castle Cromwell is said to have placed a garrison of eighty men. But, having nothing to do, they made excursions through the country, used freedoms with the women, and otherwise provoked the inhabitants so much, that they rose upon them when they were all out of the castle, and slew every one of them.

The castle seems to have been built of red sandstone, quarried from a spacious hollow on the land side, which a copious spring might still convert into a broad and deep moat, so as to cut off all approach to the castle from the land, except by a narrow neck, exposed to the guns of the bastion.

On this neck there is reason to think that a draw-bridge formerly stood, though the gap is now filled up with earth.

The Danes are said to have had a place of strength here, when they occupied this and the other Hebridian Isles, and many other settlements on the mainland Highlands. But, from the monuments of their architecture which they have left in other places, I do not think that a single stone, even of the original tower, was placed by them. Its date, therefore, though ancient, must be posterior to the occupancy of the island by the Danes. This castle has long been the occasional residence of the Dukes of Hamilton, when they visit their property in Arran; and, in their absence, it is inhabited by their steward.

The land around is laid out in square enclosures, intersected by belts of trees; and towards the north there are extensive natural woods. The soil is mostly a red, friable clay, formed from the decomposition of red sandstone and shiver; and, where of sufficient depth, is not unfertile. Above the cultivated land, the summit of the shoulder appears clad in gloomy heath, over which the sullen majesty of Goatfell frowns. It may be from three to four hundred feet of elevation above the level of the sea. It would add much to the beauty of this place, were this elevated tract of land clothed in lively green. The horrid aspect of Goatfell, scowling

ſcowling over a green declivity, projected from his baſe, would form a ſurpriſing contraſt between the ſublime and the beautiful.*

The ſtrata expoſed in Merkland Burn, on the north, are moſtly red ſandſtone †, and ſometimes white. Theſe are every where interſected by baſaltic or whinſtone veins, which often alter the poſition of the ſtrata. Theſe ſtrata frequently alternate with red ferruginous clay or ſhiver ‡. In one place, a ſtratum of red clay included nodules of limeſtone; but the quantity ſmall. Theſe ſtrata aſſume a higher angle as we aſcend the burn; and they are intercepted by ſtrata of Molaris || and Breccia, or coarſe puddingſtone. Behind theſe, what is commonly called baſtard freeſtone, or rubble ſtone, arranged in perpendicular ſtrata, occurred. This is cut off by a vein of micaceous ſchiſtus, behind which, the Blotta § of Dr Walker, but which I ſhall call primary breccia or puddingſtone,

* Lord Kaimes praiſes Inverary caſtle, becauſe it aſſimilates with the rugged mountains among which it is placed; which is like the frog affecting to emulate the ox. In ſuch caſes, our greateſt pleaſure ariſes, not from ſimilitude, but from contraſt, when we find an elegant manſion in a rugged country where we did not expect it.

† See Note [A.]

‡ See Note [B.]

|| See Note [C.]

§ See Note [D.]

ſtone, is the only rock expoſed to view in this direction, until we reach the baſe of Goatfell.

Behind Arran Caſtle, there is a very large ſtratum of limeſtone, which paſſes down to the valley below. It ſtands at an angle of 45°, and conſiſts of quadrangular blocks, imbedded in ſtratulæ of red clay marl. It is covered by a ſtratum of white ſandſtone, and the working of this quarry has been abandoned, becauſe the roof falls in, and endangers the workmen. I am inclined to think it had better be wrought by a mine, led up through the ſtratum, from the valley below. The limeſtone contains numerous ſhells, chiefly large oyſters and clams, though no ſuch ſhell-fiſhes are known to exiſt in the neighbouring ſeas.

Near the top of the hill, above the plantations, another very large ſtratum of limeſtone occurs, every way ſimilar to the former, except that it makes a higher angle with the horizon. Its working has alſo been abandoned; becauſe, being covered with a vaſt maſs of clay marl, expoſure to the air cauſes this to moulder down, and to cover the face of *the* quarry.

Were the heath burnt, and ruts cut with the plough to diſcharge the ſuperficial moiſture of the neighbouring waſte, this clay marl, or lime, ſpread upon the ſurface, would cauſe it to throw up ſweet herbage, and produce the lively contraſt with the gloomy aſpect of Goatfell, already deſcribed.

After

After traverſing an extenſive tract of moor and moſs, we arrive at the baſe of Goatfell, where the firſt viſible rock is what is commonly called *grey granite.* *

Aſcended by the ſhoulder which is projected eaſtward from the body of the mountain. Found this ſhoulder to be perpendicular on the north, and compoſed of vaſt blocks of granite, placed upon each other with conſiderable regularity, ſo as to reſemble an immenſe wall, which the ſtrata on the ſouth reſpected, like tiles placed on the roof of a houſe. Found another ſimilar wall, running at right angles to this, or nearly from ſouth to north; and their point of contact is the ſummit of Goatfell. Thus this mountain is compoſed of three ſhoulders, in the form of a T; and the lofty pinnacle at their junction forms his ſummit.

On looking round, the mind was loſt in aſtoniſhment at the terrific grandeur of the ſcenery, and was forcibly led through Nature up to Nature's God. No ſoil, but patches of mooriſh earth interſperſed amidſt naked blocks of granite. Deep and gloomy chaſms, apparently doomed to eternal ſterility and ſilence, except when the latter is interrupted by the loud roar of the torrent, or the fury of the tempeſt; the precipitous ſides, and ragged ſummits of the ſurrounding mountains, freezed

* See Note [E.]

freezed the ſoul with horror, mixed with pious admiration.

I could not help remarking how much the buildings of the Almighty frown contempt on thoſe of man. To ſuperficial obſervers, the latter may appear more regular; but the former ſurpaſs in magnitude and grandeur, and, amidſt apparent diſorder and confuſion, poſſeſs a regularity the moſt exquiſite, which we may admire, but never can fully comprehend.

A hazineſs in the lower regions of the atmoſphere, confined our proſpect to a glimpſe of Cowal, of Kintyre, the Rock of Ailſa, Ayrſhire, Bute, and the ſurrounding ſeas.

Though this mountain overlooks three kingdoms, Mr Playfair (*Illuſtration of the Huttonian Theory, p.* 314.) ſuppoſes its height to be nearly 3000 feet; and the late Mr Gerſham Stewart (*Statiſtical Account of Scotland, vol. VIII. p.* 580.) makes its height to be 2840 feet above the level of the ſea. The latter is probably the reſult of a barometrical meaſurement by the late Mr Burrel. Hence, this mountain does not poſſeſs a height proportioned to the extent of ſurface of which it commands a view.

The granite of which the mountain is compoſed conſiſts of cryſtallized fell-ſpar, commonly of a white or gliſtening colour, when freſh broken; though, in many caſes, the fell-ſpar exhibits a red-

diſh

dish brown, or rusty appearance, especially where the stone is undergoing decomposition. Among the fell-spars, silicious crystals are interspersed, in various proportions, and of various sizes. These commonly terminate in a pyramid of five sides; and are more or less of a dark or footy colour. A smaller proportion of talk enters into the composition of this granite, than is commonly found in granite of the same species; and it sometimes exhibits small crystals of schorl, of a black colour.

Many blocks, and parts of blocks, especially near the summit, consist of granite of so small a grain, that they may easily be mistaken for sandstone. The other parts are of large grain; and the fell-spar, in quantity, far exceeds the other ingredients.

The whole mountain is stratified, in many cases, with considerable regularity, though frequent troubles, or confusions, in the strata, occur. In the hollow between the eastern and southern shoulders, where the strata are exposed by a burn, when the ascent happens to be gradual, the strata do not rise at a very high angle; but when the ascent is more abrupt, the strata rise at a proportionally higher angle. On the southern shoulder, where the ascent is very abrupt, the strata rise at an angle of about 80°, or approach to the vertical position,

poſition, eſpecially in the arm which projects northward from the ſummit.

The riſe of the ſtrata is towards the wall of huge blocks, already deſcribed, on each ſide; but, on the one ſide, the riſe is much more abrupt than on the other. This ſeems to have occaſioned the ſtrata on the abrupt ſide to fall down, forming thoſe frightful chaſms, to which we look down with diſmay; and leaving a great depth of the wall, or vein, expoſed to view, by which we obſerve it to be compoſed of blocks of various, but moſtly of enormous ſize, arranged in the form of ſtrata, which here ſeldom deviate much from a horizontal poſition.

The ſtrata are interſected by two ſets of perpendicular cracks, running parallel to each other, and nearly in ſtraight lines.

The one ſet, at various, and unequal diſtances, run in the direction of the riſe of the ſtrata. The other ſet, at conſiderable, and apparently equal diſtances, croſs the former at right angles.

The effect of theſe cracks is to form the ſtrata into blocks of various dimenſions, correſponding to the diſtance between one ſet of cracks, and the thickneſs of the ſtrata, which varies conſiderably. The figure of the blocks is parallelopiped, or rhomboidal, according to the angle of elevation at which the ſtrata encounter a crack.

Similar

Similar cracks are found in ſtratified ſandſtone, called by workmen *ſlips*, *cutters*, or *backs*; and they commonly divide the ſtrata into rhomboidal blocks. They ſeem to have been produced by the ſhrinking of the ſtone in the inſtant of its conſolidation.

Some detached blocks are ſeen, of from three to four feet ſquare, and from fifteen to twenty-five feet long. But in ſome of theſe, ſmaller cracks, not viſible in thoſe that remain in their original ſtate, may be diſcovered. Had there been no other but the great and viſible cracks, the blocks ſhould have been from forty to fifty feet long. Some detached blocks, of vaſt ſize and irregular figure, alſo appear on and near the ſummit. Theſe may have belonged to the ledge or vein which forms the ſummit, and is projected from it in the three directions already deſcribed. A ſimilar ledge or vein, though of ſmaller dimenſions, runs from eaſt to weſt, and is *viſible* where the burn forms a caſcade near the baſe of the mountain.

Diſintegration ſeems to commence in theſe rocks, by the inſinuation and freezing of water, in the ſmaller cracks already deſcribed, which ſubdivides the large blocks into ſmaller pieces. Expoſure to the weather produces decompoſition in the fell-ſpar, and diminiſhes the adheſion of its cryſtals. This admits water, which freezing, cauſes them to fall off in concentric layers. This cauſe operates

operates most powerfully on the ends and angles of the blocks, where I often found a layer separated from the solid stone, and the adhesion of the crystals so far diminished, that I could crumble them in pieces by the hand. Hence, except where they are defended by a hard vein of quartz, the angles are perpetually reduced, and the stone acquires a considerable degree of rotundity, before it is so far undermined, as to roll down the mountain.

Descending by the southern and steep shoulder of the mountain, saw, at the head of the hollow where the descent begins to grow less rapid, a parallelogramic mass of granite, of vast dimensions, and about fourteen inches in thickness, placed in a horizontal position, like the floor of a house. This could not have happened from its accidentally sliding down the mountain; because, though I did not see on what the side next the mountain rested, it was elevated above the heathy surface, and the opposite side rested on two thin granites, situated near its angles, and placed on edge. In front, it is so high that people may easily shelter themselves under it. Several rounded blocks are situated below, though it rests on none of them; and they seem to have been used as props in the progress of elevating the stone. I suppose this may have been a Druidical altar, or place where religious ceremonies were performed, to which the awful

awful grandeur of the ſurrounding ſcenery would give great effect.

Below this, ſeveral copious ſprings burſt out, which, gradually collecting, form a burn. Found the heat of one of theſe ſprings to be 46°, which is probably the medium temperature of the mountain.

Where the granite rocks ceaſe to be viſible, this burn is joined by another ſtream, and they run a long way through a level ſurface, that is encumbered by huge rounded maſſes of granite.

At the head of Knockin Glen, a very large vein of ſhattery priſmatic whinſtone *, of a dark blue colour, is firſt ſeen to interſect the ſtrata. Below this, a very irregular ſpecies of micaceous ſchiſtus † occurs, arranged in ſtrata, that are nearly perpendicular, and variouſly bent. In many parts, it contains nodules, or veins, of quartz, round which the ſtratulæ are curiouſly bent and contorted. Further down, whinſtone again occurs;

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* The late Rev. Mr Ure (Hiſtory of Rutherglen and Kilbride, p. 268.) thinks, 'That the Scottiſh term *whin*, is 'frequently, in common language, made uſe of to expreſs any 'thing that is hard, ſharp, and prickly. According to this 'meaning, the whinſtone ſignifies one, the fragments of which 'have ſharp and prickly corners. The word taken in this peculiar ſenſe, is equally ſignificant with any name, as yet given 'to this claſs of ſtones, from the Greek, German, or Engliſh languages.'

† See Note [F.]

curs; and below this, Rubble ‡ or baftard freeftone, is feen, arranged in vertical ftrata. It is moftly of a red colour, of various intenfity; though fome ftrata are whitifh, or grey. Towards the bottom of the glen, the Rubble graduates into the common red fandftone.

‡ See Note [G.]

GLEN

GLEN ROSA, SHIRREG, &c.

SOUTH of Arran Caſtle, a beautiful valley, called Glen Shant, or Valley of Enchantment, about a mile in every direction, extends from the head of Broddick Bay. From the head of this valley, Glen Roſa extends about five miles towards the north-weſt, and Glen Shirreg is projected towards the weſt, being ſeparated from each other by a ridge of hills. The ſtreams which flow from theſe glens, form a junction near the mouth of Glen Shirreg, and, taking a ſweep along the ſea-beach, form an incommodious harbour for boats at the head of the bay.

There is reaſon to believe that this bay formerly extended much further within land than it does at preſent, if it did not even penetrate a conſiderable way into Glen Roſa; but the valley has been formed by ſtones and earth waſhed down from the neighbouring mountains. The ſoil is moſtly a reddiſh friable earth, in ſome parts too much encumbered with ſtones, where it is only adapted for planting. Towards the ſea-beach it is very ſteril, being moſtly compoſed of granitic ſand, conveyed by the Roſa, and beat back by the ſea. In ſeveral

 parts,

parts, draining would recover excellent ſoil; and much good land might be gained by extending cultivation along the riſing ground on the north.

In ſeveral places there are heaps of ſtones, which I take to be ancient cairns, piled upon the aſhes of the dead. In two places there are tall obeliſks, which are ſuppoſed to be monuments on the graves of heroes. But I take them to be remains of Druidical circles, or places of worſhip. A more entire circle of this ſort is ſeen on the riſing ground at the mouth of Glen Shirreg, towards the weſt; and a maſſy obeliſk, perhaps the remains of a circle, is ſeen in Broddick wood, towards the ſouth.

Glen Roſa firſt exhibits Rubble ſtone, in ſtrata nearly perpendicular, being a continuation of that in Knockin-burn, occupying the lower hills, on each ſide, at the mouth of the valley. This is cut off by a line running nearly from ſouth to north; where the micaceous ſchiſtus commences, and is continued a conſiderable way up each ſide of the valley. The ſtrata of this alſo ſtand almoſt perpendicular, and are cut off by a line nearly parallel to the former; beyond which granite commences.

The valley firſt becomes encumbered with maſſes of the ſchiſtic rock; and afterwards with more numerous, and often moſt enormous, maſſes of granite.

The

The strata of granite, though their angles of elevation be very various, always approach more to the horizon, than any of the two former. Hence, it is impossible to ascertain whether the two former strata rest upon each other, or on the granite; for they seem to rest only on themselves: and the rotundity and inferior altitude of the hills which each composes, seem owing to their more rapid decomposition.

The first granite *in situ*, that occurs in the bottom of the Rosa, is where a burn from the southern ridge forms a junction. Here it is regularly stratified at an angle of about 30°; and a granitic vein, mostly composed of vast blocks, intersects the strata, in a direction from south-west to north-east. Another granitic vein, nearly in the same direction, composed of vast blocks built upon each other like a perpendicular wall, intersects the strata further up the burn, and causes a sudden elevation of the strata below; while those above, for a great way, are rendered almost horizontal. A third vein, mostly composed of fatiscent granite, with a few solid, though smaller blocks behind, occasions a similar change in the angle of elevation of the strata, though not to such an extent as the former. All these strata have two lines of rise, and their average is from north and by west, to north-west.

The granite on the southern side of Goatfell, which bounds the glen on the north, and on the

D 2 ridge

ridge oppofite to it, which bounds it on the fouth, though it has one line of rife pointed northward, has its general elevation towards the oppofite tops of the mountains; and, viewed from the glen, appears like tiles placed on the fteep roofs of two oppofite houfes. Above thefe tiles a perpendicular wall is feen at the fummit of each ridge, refembling a wall built up through the centre of a houfe, on which the roof had refted, but part of which wall had been uncovered by the fall of the upper part of the roof.

I am hence inclined to think, that thefe veins, compofed of vaft blocks, placed upon each other in nearly a horizontal pofition, had been firft formed; and that the cryftallization, or the confolidation of the other ftrata, had commenced at them. The folid edges of thefe new formed ftrata, refting on the veins, the remoter parts would fall into an inclined pofition in proportion as they were confolidated from the liquid (whatever it may have been) in which the matter had been fufpended. The cryftallization of fome falts, which require fticks, or threads, interfperfed through the liquor, on which the confolidation may commence, forms a fort of illuftration of the views here exhibited.

I am hence inclined to reckon the vaft blocks which encumber the fummit of Goatfell, and his projecting fhoulders, as part of the vertebræ (if we may be allowed the expreffion) of the mountain;

..ain; and the ſmaller veins projected from them in various directions, to reſemble the ribs, or ſmaller bones. The formation of the other ſtrata around theſe, has occaſioned all that variety in the line and angle of elevation which diſtinguiſhes the ſtrata of granitic mountains.

Though the ſtructure of the granitic veins is not always ſo regular as it is here deſcribed, yet, in general, where ſeen *in ſitu*, they conſiſt of blocks of various ſize, but many of them immenſe. Theſe are built upon each other with conſiderable regularity; their lines of ſeparation are regular, and always deviate ſomewhat from the plane of the horizon. The other ſtrata deviate much more violently from the horizontal plane; many ſections of them, though very broad, are of inconſiderable thickneſs; and the thickeſt, though they often furniſh blocks of great length, are far from being ſo maſſy as thoſe furniſhed by the veins.

To prevent unneceſſary repetitions, I have thrown together theſe general obſervations, which I had made on the ſtructure of other granitic mountains; but the deep chaſms which interſect thoſe of Arran, expoſe their ſtructure more fully to view than any others I had obſerved. A ſimilar ſtructure I have ſometimes ſeen in ſtrata of ſandſtone; and whether the cauſes here aſſigned be well or ill-founded, the facts are open to obſervation.

At a cascade where the Rosa has cut a deep channel, a vein of fatiscent whinstone, about twelve feet thick, crosses it; and then, suddenly turning, follows a zig-zag direction along the bottom of the burn. On the north side of the cascade, where this vein comes out to the surface, it is decomposed into a dark-coloured earth. The other parts consist of nodules of a dark blue whinstone, imbedded in a softer matter, which is formed from the decomposition of the nodules in concentric layers. The cascade, and the deep chasm, have been formed from the water having scooped out the whinstone vein.

But what struck me most, was two veins of granite, standing perpendicular, and parallel to each other, and inserted exactly in the centre of the whinstone vein, in the bottom of the chasm. Great part of these granitic veins must have been swept away by the water; but the fragments which remain are of considerable breadth, and stand about four feet above the surface of the pool. They are each about four inches in thickness, and are separated by about two inches of whinstone, of the same species with the rest of the whinstone vein.

The granite, of which these veins are composed, is extremely compact: its fresh fracture is white, with a glistering appearance, like rhomboidal spar of lime; exhibits no silicious crystals, but only fell-

fell-ſpar, with very thin laminæ of talk, of a dark colour, interſperſed.

The ſides of the chaſm are compoſed of broad and maſſy quadrangular blocks of granite, leaning, at a ſmall angle, towards the mountains on each ſide. The granitic ſtrata being pretty regular above and below this place, I am inclined to regard theſe blocks as part of a primary vein, croſsing from mountain to mountain; only the blocks, in place of being arranged horizontally, like thoſe I have deſcribed, ſtand almoſt perpendicular.

Towards the lower part of the chaſm, the whinſtone vein paſſes under the granite, and the ends of the blocks are ſeen to reſt upon it. Here it either terminates, or continues its progreſs under the granite; becauſe it is no where ſeen at the ſurface beyond this.

At the head of Glen Roſa, the burn divides into two branches. One from the weſt comes down from a deep hollow, emboſomed in the granite mountains. The other, from the north, deſcends from an elevated ridge, interpoſed between this and Glen Iorſa *. In this ridge the ſtrata continue to be pretty regular; and the ſudden elevation is cauſed by numerous croſs veins, conſiſting of large blocks, arranged in nearly a horizontal poſition, as formerly deſcribed. Theſe

 interſecting

* Pronounced *eerſa*.

interfecting the inclined ftrata, caufe numerous cafcades in the burn, and prevent the latter from being fwept away.

In many of the inclined ftrata in Rofa burn, efpecially towards the lower parts, I obferved rounded blocks, and nodules, of various fpecies of ftones, inferted in the granite. Thefe were of various fhapes and fizes; but all of them more or lefs rounded and water worn. Some contained various concretions, inferted in a fandy fubftramen. But moft of them exhibited a bluifh, or greenifh grey, appearance on the outfide; their fracture jafpidean, white, and fparkling; but afterwards refumes the outfide colour. Thefe feem to be compofed of very fmall particles of quartz, inferted in a clay ground.

The granite was uniformly moulded around thefe blocks, or nodules, the hollow taking their exact fhape; but nowhere adhered to them. So far from this, where there was no projecting part of the ftone, over which the granite had clofed, they could eafily be picked out.

Thefe concretions are very different from the fmall-grained granite on the fummit of Goatfell; for, though the latter fills up hollows, or makes part of a block, it is never water-worn, and always adheres firmly to the block of which it makes a part.

Having

Having obferved fimilar phenomena in other granite rocks, I drew a conclufion, that the divifion of mountains into primitive and fecondary, was without foundation; that mountains are primary and fecondary only in a relative fenfe, as it refpects the time of their progreffive formation; but that none are primitive in an abfolute, unconditional fenfe. In granite mountains, I never obferved any remains of organized bodies; and hence concluded, that their formation had preceded the exiftence of animals and vegetables. But the blocks and nodules here alluded to, muft have made part of rocks which exifted before the granite was formed, and, during the formation of the latter, were enclofed within its ftrata.

Through Glen Shirreg, a road, or rather tract, conducts to the oppofite fide of the ifland; and a good road might eafily be made in this direction. The hills on each fide are moftly compofed of red fandftone, interfected by numerous veins of whinftone; the foil chiefly a red, friable clay. The fouthern ridge exhibits terraces rifing above each other, where a little draining might improve the pafture, or much land might be added to cultivation. This ridge terminates in hills of primary puddingftone, which here occupy the fummit of the ifland.

Below the farm-houfes at the mouth of the glen, a large body of red clay marl, mixed with

ſmall ſtones, is expoſed by the burn. This might prove an excellent corrective of the defects of the ſoil above it, and of others contiguous, which are either ſand or gravel.

Near the ſummit of the ſouthern ridge (called *Broddick*, or *hill of gentle riſe*), a very large, and nearly vertical ſtratum of limeſtone, is ſeen running below a ſtratum of white ſandſtone. This limeſtone is every way ſimilar to thoſe already deſcribed; and a ſtratum of red marly ſhiver, between it and the ſandſtone, exhibits numerous ſpecimens of various ſea ſhells. The limeſtone has been partially wrought in various places; but has been abandoned, by reaſon that the falling of the freeſtone ſtrata endangered the workmen. I am inclined to think that mining would prove the eaſieſt and ſafeſt way of working it.

Many large rounded maſſes of granite are ſcattered over this ridge; though there are no granite rocks, in this direction, from which they could roll.

On the northern declivity ſaw many maſſes of pitchſtone; though I could not find any ſolid rock of that foſſil.

GLENCLOY, GLENDOW *, &c.

GLENCLOY is ſeparated from Glen-Shirreg, by the gradually riſing ridge called Broddick Hill, the northern ſide of which I have attempted to deſcribe. It runs about three miles weſtward from the ſouthern head of Broddick Bay, and is generally a level plain, in moſt places nearly a mile broad. It contains much alluvial ſoil, of a good quality, being chiefly a reddiſh friable earth, which long cultivation has in ſome places made to aſſume a blackiſh hue. Some parts are moſſy, others ſwampy, ariſing from ſprings which are in a progreſs of being drained, and the land they deſtroy reduced to cultivation.

A tract, contiguous to Broddick wood, where the Roſa joins the bay, is occupied by granitic ſand, and is equally ſteril with the tract deſcribed as formed from that ſpecies of ſand on the northern ſide of Roſa. Behind this, ſeveral ruts are diſcernible, ſhewing the various channels the Cloy, or ſtream which runs through the glen, had formerly ſcooped out. Behind theſe, we come to an elevated bank, which exhibits the appearance of a

* *Black Glen.*

a regular fort, with ravelins and baſtions; where the old channel of the Cloy, in front, may naturally be miſtaken for the remains of a wet ditch. This elevated ſpace is moſtly compoſed of ſmall rounded ſtones, and, towards Broddick Hill, of looſe ſand, with a ſmall intermixture of ſoil. It is neither adapted for paſture nor cultivation; but might carry, with advantage, ſome ſpecies of trees. On the riſing grounds which bound the vale, the ſoils are primitive, and are formed from the argillaceous ſandſtone and ſhiver on which they reſt; where clay generally predominates more than in the alluvial.

About half way up this glen, on the ſouth ſide, emboſomed amidſt natural woods and plantations, ſtands the commodious manſion of Captain Fullarton, long celebrated for hoſpitality and a kind reception of ſtrangers.

Glencloy is bounded by high hills, forming a ſort of amphitheatre towards the north-weſt and north. The water divides into two ſeparate ſtreams; and a projecting point narrows the valley, the ſouthernmoſt continuation of which is called Glendow; I ſuppoſe, from the thick and rank heath, which gives it a black appearance.

This glen terminates in a circular hollow, or *corry* *; in ſome parts marſhy; ſurrounded on the

* A ſmall hollow.

the eaſt by a ſemicircular mound of large rounded ſtones, and detached heath-clad rocks, through which the waters have formed a narrow paſſage; on the weſt by an amphitheatre of perpendicular rocks, over which rills of water are precipitated in white foam. The length of Glendow from Glencloy may be about two miles.

The ſtrata of the ridges which bound the glen on each ſide, are red ſandſtone, intermixed with ſtrata of coarſe pudding, or breccia, and variouſly interſected by whinſtone veins.

In the lower part of the glen, near Broddick wood, the ſandſtone ſtrata are thrown up, and a great body of pitchſtone is expoſed to view. It is generally of a dirty green colour; aſſumes a greyiſh tegmen, or cruſt, by expoſure to air, which alſo penetrates into its cracks and vacuities. It exhibits numerous ſmall ſpecks, apparently fellſpars, in a ſtate of decompoſition. But ſome parts of it are of a lively bottle-green colour.

The hills at the head of Glencloy are compoſed of wacken porphyry †, in the form of rude columns, occupying the ſummit like a mural crown. Earth and fragments cover the ſtrata below, and prevent us from ſeeing on what they reſt. They, too, are interſected to their ſummits by whinſtone veins.

At

† See Note [H.]

At the head of Glendow, on the ſouth, the ſtrata of ſandſtone are ſeen to aſſume a higher angle, and become nearly vertical, as they approach the mountain rocks. The latter are primary breccia, forming a wall of from about two to three hundred feet perpendicular; and are alſo interſected to their ſummits by whinſtone veins, which have generally become water-courſes. † This breccia has no appearance of ſtratification.

The ridge which bounds Glencloy on the ſouth, is above a mile broad in moſt places, and riſes equally from the head of Broddick Bay to the ſummit of the hills above Glendow. It is only partially cultivated on the lower parts; but might moſtly be reduced to cultivation. The ſoil is a red clay, in which heavy rains uncover numerous agates and calcedonies, in certain places. Theſe have been derived from the decompoſition of ſoft ſtrata of breccia; and we ſhall ſee that theſe and other ſtones abound in ſuch ſtrata in various other places.

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† Mr Jamieſon (Mineralogy of Arran, p. 60.) found ſyenite in Glencloy. I had not followed the ſame route with him; for, except in puddingſtone, or breccia, I did not ſee any of this ſtone in Arran.—See Note [I.]

PROMONTORY BETWEEN BRODDICK BAY AND LAMLASH.

THIS promontory is formed into a peninſula by two burns, which, deſcending from the hills, ſuddenly diverge from each other nearly at right angles; the one falling into Broddick Bay, on the north; the other into Lamlaſh Bay, on the ſouth. The deep chaſm of Corry-gills, where are two farms belonging to the Marquis of Bute, forms a ſmaller promontory on the north. Moſt of this laſt promontory is either cultivated, or capable of cultivation; but draining is in many parts neceſſary.

The main promontory has its centre occupied by jutting rocks; while ledges, decreaſing in altitude, form the land into a ſort of terraces on either ſide; and from the ſummit, a perpendicular ledge, facing Broddick Bay, decreaſes in altitude, until it terminates in the point of Clachland, which forms the north entrance of Lamlaſh bay. The higheſt of theſe hills is Duin-Dug, which overlooks Corry-gills, is detached from the others, and may be from four hundred to five hundred feet above the level of the ſea. The ſoil, in this tract,

tract, is similar to those already described, mostly of a reddish colour; and in some places clay too much predominates, in others sand. The patches cultivated bear no proportion to the extent which might be profitably subjected to the plough.

On the hill behind the minister's manse, to the east of the road, are some tall obelisks, which seem to have been Druidical circles, or places of worship. Contiguous to these, is a circular mound of loose stones, which seems to have been a small Danish encampment. Further east, are the ruins of what seems to have been a conical building, or fort, such as are still seen in Glenelg, Kintail, Lochalsh, &c.; though the most entire of any I have seen is in the parish of Lochs, west side of the island of Lewis. On the top of Dun Fioun (Fingal's Fort) there is a round eminence, distinguished amidst the heath by its verdure, which seems to have been a vitrified fort, such as abound in the North Highlands, though it is now concealed by soil and grass.

At Springbank, on the boundary of this tract, Mr MacAlister has built a commodious house and offices, where the frank and hearty hospitality of the ancient Highlanders is combined with modern elegance; and where the traveller forgets his toils, or thinks them well bestowed, when they conduct to so much happiness. He has laid out an elegant garden; and is employed in reclaiming an extensive

five tract of waste land, by enclosing with substantial stone fences, draining, liming, &c. &c.

On advancing along the shore, from the head of Broddick Bay, the strata on the beach, and in the rocks which compose the sea-bank, are mostly red, and sometimes white sandstone, alternating with strata of breccia, or coarse puddingstone. The latter are generally of great hardness, and include pebbles of small size, of various species, and very much rounded, constituting the stone called by some amygdaloid. Some of these strata, where the concretions are very small, and the hardness great, I doubt not, would make excellent millstones; a commodity much wanted in this island. But by far the best millstones might be procured from a proper selection of the granitic strata, which might be so constructed, as not only to grind corn in the usual way, but might also serve the purpose of burr-stones to grind flour.

These strata are variously intersected by whinstone veins. A remarkable one is noticed by Mr Playfair. It runs straight from north to south, and intersects the sea-bank to its summit, at the place where the first steep rock occurs below the head of Broddick Bay. Others follow a zig-zag course, and often terminate before they leave the sea-beach; or are intersected by, or ramify into, other veins, which often penetrate the sea-bank; and in all cases where I happened to see a vein

penetrate the ſea-bank below it interſected the rocks at the ſummit.

Having pointed out the general character of the ſtrata in this tract, I now beg leave to enter into the minute particulars which were obſerved while exploring it.

After paſſing Springbank, the firſt object that attracts notice, is a high rock, cauſed by what is called an up-throe of the metals. I ſhall afterwards have occaſion to explain more fully the ſtratification of the metals in this iſland. At preſent, it is only neceſſary to obſerve, that all ſtrata of granite, ſandſtone, puddingſtone, &c. &c. have two lines of dip and riſe; one towards the contiguous mountains, another making a right angle, or one more or leſs, with this direction. The true line of dip and riſe, is the diagonal between theſe two inclinations. This up-throe running weſtward, forms a ſort of ridge, which divides the Duke of Hamilton's property from that of the Marquis of Bute.

After paſſing this higheſt part of the rock, its height is ſeen rapidly to decline; and there, below the farm of Eaſt Corry-gills, a circumſtance occurs, to which, though I have ſeen ſeveral approaches, I never ſaw any ſo perfect. A ſtratum of white ſandſtone is ſeen included between ſtrata of red ſandſtone, and interſected by perpendicular cracks, or planes, ſo as to be formed into moſt regular,

regular, and truly perpendicular quadrangular columns.

These columns are composed of argillaceous sandstone, of very fine grain, and great durability; easily cut by the chisel; susceptible of the highest polish of which sandstone is capable; the columns, in section, being from three to four feet square, without longitudinal cracks or subdivisions.

These columns rest on a stratum of red sandstone, which dips at a very small angle towards south-east. They are covered by strata of the same sandstone, which dip, in the same direction, at an angle of about 45°.

The highest column of white sandstone towards the north-east, may exceed forty feet perpendicular; and the columns towards the south-east are diminished in altitude by the dip of the incumbent strata, until the last one exhibits an altitude of only about six feet. Thus, the columns exhibit a very lively representation of one side of the pipes of an organ; the line from the highest to the lowest column forming an angle of nearly 45°.

Where the last column terminates, a stratum of pitchstone commences, and gradually diminishes in thickness, until, with the superincumbent strata, it is lost in the rubbish thrown down by the burn from Corry-gills.

 The

The ftratum of pitchftone is, in fome places, amorphous and fhattery; in others, it is arranged in the form of columns, which are of a fplintery fracture, of a jet-black colour, though, in fome pofitions of the light, they exhibit a flight tendency towards green. This pitchftone exhibits a filken glofs, which does not tarnifh by expofure to the air.

The higheft part of Dun-Fionn may be about three hundred feet above the level of the fea. It is furmounted by a ftratum of wacken porphyry, moftly arranged in the form of rude columns, which form a perpendicular ledge on the northern fummit, inclined according to the inclination of the ftrata on which they reft, until they are loft in the northern extremity of Lamlafh Bay, called Clachlan Point.

This ftratum refts upon a white ftratum of argillaceous fandftone; below which, red fhiver and fandftone alternate, until we reach a projecting ftratum of red fandftone, below which is fituated a very thick ftratum of pitchftone; and below this, red fandftone is continued to the fea-beach.

The fhiver here, contains a portion of calcareous earth; and to its decompofition I am inclined to afcribe the white, red, and yellow clovers, and the great variety of highly nutritious graffes which grow with fo much luxuriance, not only on the

fteep

ſteep ſides of the hill, but alſo among the ſtones on the ſea-beach.

The wacken porphyry which ſurmounts Dun-Fioun, with the ſtrata on which it reſts, is, in ſome places, interſected by whinſtone, or baſaltic veins of a dark blue colour. In ſome caſes, theſe veins are fatiſcent at top, being compoſed of blocks which decompoſe in concentric nuclei, while below they are endowed with great durability. In ſome places, the decompoſition of theſe veins above has left gaps in the ledge of wacken porphyry. On examining theſe veins on the ſea-beach at ebb-tide, I found that only a few of the larger ones, into which many others ramify as already ſtated, penetrate the hill. The direction of theſe is from a few points weſt of north, varying from that to north-weſt. Moſt of theſe are ſtraight; ſome are curved; but moſt of the others are either zig-zag, or curved. In ſeveral caſes, the ſandſtone is penetrated with particles, or even exhibits large blocks of the whinſtone immerſed in it; while the whinſtone, again, is penetrated by particles of ſandſtone, or includes blocks of it of a white colour. White ſandſtone in theſe veins ſurpriſed me the more, as the ſtrata which they penetrate are red ſandſtone. But what ſurpriſed me ſtill more, was pieces of granite and porphyry, more or leſs rounded, included in ſome of theſe whinſtone, or baſaltic veins.

 The

The mutual penetration of the particles of the whinſtone and ſandſtone, never extends far on the ſide of the vein, and ſeldom exceeds an inch; though, moſt frequently, it ſcarcely amounts to one fourth of an inch; and on the vein the whinſtone predominates. On the ſide of the ſandſtone, which forms the cheeks of the vein, the ſandſtone predominates; and the whinſtone gradually diminiſhes in quantity, until it is loſt in the ſtrata, often at the diſtance of more than a foot. The veins are dark blue, and very hard whinſtone; and the ſtrata, which either penetrate, or are penetrated, are red ſandſtone; the colour of each, except ſo far as altered by intermixture, being retained in the compound.

With regard to the white ſandſtone, granite, and porphyry, found included in the veins, they certainly had not been ſubjected to any uncommon degree of heat; a moderate quantity of which would have converted the ſandſtone into looſe particles—would have looſened and rendered ferruginous the cryſtals of granite—and an exceſſive temperature would have liquified theſe bodies, and blended them with the common maſs of the vein in which they are included. In place of this, the ſandſtone, granite and porphyry, exhibit no ſenſible variation from rocks of the ſame ſpecies in the iſland.

The ſtratum of pitchſtone is high above the beach at its outcrop, and runs about a quarter of

a

a mile, with an uniform thicknefs, and the fame inclination with the ftrata which include it, until it is loft among the ftones and rubbifh on the fea-beach. Its thicknefs may be about ten feet. In moft places it exhibits a white, and in others a rufty brown, tegmen or cruft, which invefts the furfaces through its feveral cracks. Its colour varies from a greyifh green to a very dark bottle green. In feveral parts ferruginous or whitifh fpecks are feen, which feem to be fmall fell-fpars in a ftate of decompofition. In places where the darkeft colour prevails, no fpecks are feen; nor does the ftone tarnifh, or affume a cruft, by expofure to the air.

The whole ftratum is fubdivided by cracks, or parallel planes, by which it is formed into quadrangular columns of great thicknefs. Many of thefe columns have fallen down, and encumber the fea-beach. Some, from the decompofition of the fandftone on which they reft having fhifted from their original pofition, reft only on their interior edge, and threaten every moment to crufh the fpectator to atoms.

Thefe columns are fometimes compofed of fhiver, or laminæ, irregularly arranged; but, in moft cafes, they are made up of a great number of fubordinate columns, varying in length from four to twelve inches, and their breadth ftill more various. Thefe fubordinate columns are frequently

ly arranged in parallel ſtrata; between which laminæ, or ſtratulæ of a darker colour, and not liable to decompoſition, are often interpoſed.

The wacken porphyry, at the northern point of Lamlaſh Bay, affects a rudely columnar form, compoſed of ſeparate ranges which are cut by the ſea. They exhibit numerous fell-ſpars, and cryſtals of lime, of a white colour, and ſatin gloſs. Some of theſe ranges contain angular pieces of dark blue whinſtone, granite, and other ſtones.

On the ſouth, this porphyry is ſoon intercepted by red ſandſtone, which occupies the coaſt to Lamlaſh.

South of the point, on the farm of Eaſter Clachlan (Stoneyfield), a ſteep bank has puſhed out, and expoſed a great depth of excellent clay marl, mixed with a proportion of ſtones. This marl is under a ſoil, whoſe chief defect is too great a proportion of ſand.

The two farms of Eaſter and W[illegible]achlan, have a ſouthern, or ſouth-eaſtern expoſure, and exhibit much good land that has never been touched. The ſtones with which the ſoil is occaſionally encumbered, are hardly ſufficient to make the neceſſary fences and drains. On the ſea-beach are patches of moſs, covering ſea-ſhells, which are occaſionally uſed as manure. Theſe ſhells muſt have been depoſited when the ſea occupied a higher level than it does now; and, at the ſame time, the

caves

caves in the rocks, on the fea-bank, muft have been formed.

Within tide-mark, below the farm of Wefter Clachlan, faw a fpecies of pitchftone, of which, faw no parallel in Arran. The fubftramen, or ground of the ftone, is pitchftone, of a dark bottle green colour, through which are interfperfed rounded pieces of quartz, of a brilliant white colour. The quartz and the pitchftone, though feparated by lines diftinctly defined, do not form feparate ftones; but are evidently a continuation of the fame ftone. The only difference feems to be, an infufion of the colouring matter of the pitchftone; but how this has been infufed fo as to leave rounded nodules, of various, but many of confiderable fize, free of any colour, exceeds my comprehenfion. This ftone lofes its brilliancy by long expofure, to the air, though it affumes no tegmen.

In feveral places of the lands above, is feen pitchftone of all the varieties already defcribed. But fome is of a dull black colour, both on its furface and fracture; its fragments quadrangular or rhomboidal; and contains many fell-fpars, fome fmall, many large; but all more or lefs rounded. This is true pitchftone porphyry. In the gulley at the farm-houfe of Wefter Clachlan, is a very large ftratum of dark green pitchftone, included between ftrata of red fandftone, which does not tarnifh by expofure to the air.

On

On the sea-beach, below Wefter Clachlan, a bore was formerly fent down in queft of coal. But the borer happened to break his rods, which he could not extract; and this accident ftopped his operations, before he had penetrated to any great depth. The people here are firmly perfuaded that he broke his rods intentionally, after he had touched coal, being bribed by the coalmafters in Ayrfhire. From the fuggeftions of ignorant people, who have vifited the ifland, they hold the pitchftone, which abounds in this promontory, to be either coal in a particular form, or an infallible fymptom of coal: and they exprefs themfelves in very ftrong terms on the abfolute certainty of coal being here, and near King's Cove, on the oppofite fide of the ifland. Attempting to undeceive them, only makes them wax wroth, and to throw out very broad hints, that you, too, are bribed by the coalmafters of Ayrfhire.

But I fhall ftate a few reafons, which appear to me conclufive againft the exiftence of coal, either here, or at King's Cove.

1. Pitchftone, in place of being favourable to coal, appears to me to be an utter repellent of it.

2. Between the outcrops of the ftrata, here are no ftrata of blaës, or the ufual metals attending coal.

3. Though a ftratum of very white fandftone, and of very fine grain, is occafionally feen interpofed

between

between the ſtrata of red ſandſtone, yet this white ſandſtone is very different from the ſandſtone which uſually covers coal. The latter is generally of a blue or bluiſh colour; of a grey or whitiſh grey; of a yellow or whitiſh yellow colours. The blue, and bluiſh, are generally of fine grain, but often hard. The grey, and whitiſh grey, are generally ſoft, and eaſily cut by the chiſel, but moſtly of coarſe grain, unſuſceptible of a fine poliſh, and ſoon tarniſh by expoſure to the air. Theſe often contain martial pyrites, which makes them aſſume a black colour; and, by their efflorеſcence, makes the ſtone fall off in thin ſcales. The yellow, or yellowiſh white, is commonly of ſmall grain, and eaſily cut. But where there is a mixture of the whiteiſh grey with the yellowiſh white, and a very ſmall grain, the ſtone is generally very hard; but ſuſceptible of a poliſh in which you can ſee your ſhadow. Theſe are the ſandſtone ſtrata which, as far as my obſervation extends, uſually accompany coal.

4. With a very few interpoſitions of white ſandſtone, the ſtrata here are red ſandſtone: and I never yet heard of coal, or ſaw it under ſandſtone of this deſcription.

5. The ſtrata here are ſo much interſected by whinſtone veins, or dikes, that though coal were found, its continuity would be interrupted at very ſhort diſtances, often not exceeding a few ſquare yards.

I am aware that I appear like the honeſt man who undertook to aſſign five reaſons, to a criminal court, why a principal evidence did not appear at a trial. His firſt reaſon was, 'My Lords, the man 'died yeſterday.' On which he was ſtopped, and informed that there was no occaſion to bring forward his other four reaſons, the firſt being perfectly ſufficient.

Returning over the hills, an irregular ſtratum of pitchſtone is ſeen near the top of Dun-Fioun, and contiguous to the vitrified fort. It reſts on the tops of the columns of wacken porphyry, which on this ſide ſlope at the ſame angle with the red ſandſtone which riſes towards it, and probably, at one time, covered both the pitchſtone and wacken, ſhowing that the latter is merely an angular ſtratum interpoſed between the other ſtrata.

Other pitchſtone is viſible in the hollow between Dun-Fioun and Clachlan-Dun; though this is ſurrounded by ſoil, and the ſtrata with which it is connected are not viſible.

The hill of Clachlan-Dun is ſomewhat higher than Dun-Fioun, and exhibits a perpendicular ledge of rudely columnar wacken porphyry, facing the north-eaſt and north, which is probably a continuation of the ſame ledge which ſurmounts Dun-Fioun. The ſide of this hill, towards Broddick Bay, is not ſo abrupt and precipitous as that of Dun-Fioun. It is all covered with earth and ſtones,

ftones; evidently the wrecks of decompofable ftrata; but, except towards its bafe, where red fandftone appears, there is no opportunity of afcertaining the ftrata of which it is compofed.

Near the higheft pinnacle of this hill, and a fhort way below the ledge of wacken porphyry, a vaft body of pitchftone juts out. About fixty feet perpendicular below, a body of equal magnitude is feen.

Thefe bodies of pitchftone are furrounded with foil, fo that we cannot fee the ftrata with which they are connected. They are generally of a very dark bottle green colour; often approaching to that of real pitch, or jet; affume no tegmen; and their ftructure is either fhattery or lamellar, feldom columnar.

The top of Dun-Dug, north from this, is furmounted by the moft perfect bafaltic columns * I any where obferved in Arran. Thofe I examined are of five equal and fmooth fides, about fourteen or fifteen inches diameter; and expofure to the weather has caufed them to affume a white tegmen, which generally penetrates to a confiderable depth. The columns lean confiderably towards the fouth-eaft, and fome are nearly horizontal. They probably reft upon foft materials, which having been decompofed, they have jutted out

* See Note [K.]

out below, and broken into many fragments above. Did not fee on what they refted, but fufpect it to be fandftone or fhiver. When broken to fome depth, they are found to contain many rounded fmoaky quartz, with more or lefs of rounded fell-fpars, of a white colour, though fometimes black, inferted in a ground of dark blue bafalt. They are, therefore, true bafaltic porphyry.

Pitchftone is feen jutting through the foil in various places to the north and north-weft of this hill. In one place near a fmall burn, it is thrown almoft on edge, and exhibits all the external characters of a dike, or vein. But it is feen to reft on red fandftone, which makes the fame angle with the horizon as the pitchftone; and hence, this muft be a trouble in the metals, not a vein.

On the northern afcent of the hill, a very broad ftratum of pitchftone croffes the Lamlafh road; and from the way it has been cut in forming the road, exhibits all the appearance of a vein. It is compofed of feveral fubordinate ftrata, which vary in colour, from a dirty to a dark bottle green; and is very fimilar to the pitchftone near Broddick Wood. From infpecting the neighbouring burn, it is feen to be a ftratum included between two ftrata of red fandftone.

The hills above this promontory are compofed of red fandftone, alternating with red, and fometimes white fhiver. The firft are fometimes calca-

reous,

reous, and occafionally exhibit fmall rounded nodules of limeftone. Thefe ftrata are alfo interfected by whinftone veins, and are continued until they meet the primary puddingftone, defcribed as bounding Glen-Dow.

Near the bottom of the burn which bounds this promontory on the fouth, a vaft body of red clay marl is feen above the mill, and below the manfe, of Kilbride. The land contiguous to it, efpecially towards the fouth, is moftly a fteril fand, which this clay would confolidate.

Within tide-mark, in Lamlafh Bay, near this place, there is a confiderable ftratum of coralline fhell-fand, which the people take out, at ebb-tide, for manure. It is faid to get below earth towards the land; and may probably pafs up through the glen, which has been formerly occupied by the fea, though now filled with earth wafhed from the hills.

ISLAND

ISLAND OF LAMLASH, BAY, &c.

The island of Lamlash is stretched across a spacious bay, which it defends from every storm. Its Gaelic name, when translated, is *Holy Isle*, because St Molios * long chose it as the place of his residence. I saw a cave on the western side of the island, in which he lived. It is an excavation in the red sandstone which forms the basis of the island, formed by the sea when it occupied a higher level than it does now; aided apparently by art. There is a narrow projection of rock, a little elevated above the floor, which is said to have been his bed; and the mouth of the cave seems to have been defended by a wall of loose stones. Adjoining to the cave, there is a spring of very pure water, for which a cistern has been built of masonry, with a stone spout which delivers the water. This spring has been long celebrated for its miraculous cures of every disease incident to the human frame; and people come from very remote distances to bathe their debilitated limbs in the cistern, or to imbibe

* Pronounced Molees; *o* after *i* in Gaelic being quiescent, and *i* marking the same sound as *ee* in English.—Molios means *servant*, or *shaveling*, of *Jesus*.

imbibe its life-reftoring water from the fpout. This miraculous power was fuppofed to have been conveyed to the water in confequence of the prayers and benedictions of the Saint: and though the fpring has long ceafed to work miracles, the people ftill entertain for it a fort of fuperftitious veneration.

I could not help remarking, that this Saint, along with many others whom I may have occafion to fpecify, acquired his celebrity, when dirt, naftinefs, and abfurdity, formed the moft prominent features of fanctity. Had he chofen a fimilar cave on the oppofite fide of this ifland, where no boat could approach him, and where people from Arran could not get to him without danger of breaking their bones among the loofe fragments of rock, with which the beach is encumbered, we might have believed him to have retired from the haunts of men in downright earneft. But he chofe a refidence where the channel is narroweft, and moft eafily acceffible from Arran, and within the bay, where veffels from all quarters would find fafety. Hence his object muft have been, not to retire from the world, but to draw the world after him; and I doubt not but in this cave he difplayed more pride, vanity, and pompofity, than Diogenes in his tub, or Bonaparte while feating himfelf upon a throne.

Oppofite to the village of Lamlafh, at the broadeft part of the bay, there is a fmall veftige of what was formerly a religious houfe; but whether occupied by monks or nuns, I could not learn. It was founded either by St Molios, or, in confequence of the fuperftitious veneration for the ifland, occafioned by his having confecrated it by living in the cave. Their church was long the only church belonging to Arran; and after a church was built on the Mainland, they ftill continued to bury their dead within the confecrated ground of this monaftery. It happened, that a fudden fquall of wind overfet an overloaded boat, and drowned feven people attending a funeral proceffion; and, fince that time, the people bury their dead around the feveral places of worfhip in Arran.

The ifland may be about two and one half, or three miles long, and about half a mile at its broadeft part, which is where it is higheft. Below, it is moftly compofed of red fandftone, on which are placed range above range, or rather *ftratum fuper ftratum*, of rudely columnar bafalt. But in all cafes where I obferved the columns refting on the fandftone, a ftratum of white fandftone was always interpofed between the red fandftone and the columns. Thefe ranges of columns, rifing above each other, convey to the ifland an afpect of gloomy grandeur. From a barometrical meafurement

furement of the late Mr Burrel, it appears that the higheft pinnacle is 297 yards, or 891 feet above the level of the fea. Mr Burrel alfo eftimates the ifland to contain 18 acres arable, (I fuppofe he means land that was cultivated in his time), and 446 pafture, making the whole ifland 464 acres. At the fouth end from 50 to 60 acres of foil well adapted for fown graffes and green crops, might be brought into cultivation. I was told that a few acres here were formerly ploughed, and yielded an excellent crop of oats. The crop was put up into a ftack upon the fpot; but which, when they came to remove it, was found to fwarm fo much with ferpents, that they were obliged to fet it on fire.

The ifland is rented by Captain Hamilton of the Revenue Cutter, and depaftured by a few fheep and goats. The Captain has built a commodious houfe near the north end, and has laid out an extenfive garden, where he raifes every ufeful, and many ornamental, vegetables, in the higheft luxuriancy and perfection, on a foil compofed almoft entirely of bafaltic pebbles.

The fides of the ifland generally exhibit a perpendicular wall, compofed of ftrata of fandftone, furmounted by *ftratum fuper ftratum* of rude bafaltic columns, forming a fort of terraces on the weft fide.

South from the Saint's Cave, thefe columns confift of a fpecies of bafalt, of which I never be-

fore saw any parallel. Except by superior hardness, their fracture is not to be distinguished from sandstone, of a tolerably fine grain. Their colour is either white, greyish white, or yellowish white; the two last occurring most frequently. They may easily be mistaken for columnar sandstone; but the circumstance which decides them to be of the basaltic genus, is, that when struck by a hard body, or their fragments struck against each other, they emit a tinkling sound. This last quality is laid down by Dr Walker as a discriminating character of basalt.

I shall therefore call them arenaceous basalt.

Further on, towards the south end of the island, where the basaltic cliffs become high and precipitous, they are composed of columns of immense size, of a quadrangular form, each of which is made up of thin laminæ, every way resembling slates, adhering together in a very irregular manner, but easily separable; and many of them might even be formed into slates of sufficient size for covering houses. The surfaces of these slates exhibit a dark, glossy, blue colour, of various intensity, derived apparently from a coating of petroleum, or mineral pitch. Their cross fracture is bluish grey; their hardness great; and they tinkle when struck against each other.

The last mentioned columns do not, like the others, rest upon the sandstone, but intersect both it

it and the other columns, and seem to occupy an immense vein, running nearly from north to south.

After passing these massy columns, we find the basis of the island occupied by white sandstone, of a very fine grain. Here the rocks become lower, and the sandstone is cut off by what seemed veins, or compartments of white arenaceous basalt, or perhaps silicious sandstone; for I had not time to examine them minutely.

On the sea-beach around the flat land at the south end, several veins are observable. The first that occurs is a large vein of fatiscent whinstone †, composed of large rounded blocks, of great hardness, radiated or fibrous, and difficult to break, inserted in a softer matter, of a black colour, arranged in concentric layers; apparently the former decomposed. At the south end are several large veins of basaltic porphyry, some of which affect a rude columnar form. Several of these veins, and others in the island, are seen to intersect not only the sandstone strata, but also the columnar strata of basalt which rest upon them.

Returning northward, on the opposite side of the island, the large vein of fatiscent whinstone is seen running in its original direction, which is nearly towards north-east. Beyond this the rocks become

† See Note [L.]

become high, and are composed of strata of white sandstone, placed at an angle of about 45°, having strata of fatiscent whinstone interposed between, or alternating with, the strata of sandstone. Some of the whinstone strata are of considerable thickness, and are composed of huge blocks inserted in a softer matter, such as has been already described. These blocks contain numerous zeolitical concretions, mostly of a white colour, a silken gloss, and radiated crystallization. Many are like fans, spread to various extent, sulcated from the centre, and are that variety of zeolite, absurdly called Tremolite. Were it not for their flatness, they might easily be mistaken for sea-shells; though they cannot impose upon one who has seen real shells, of large size, and perfect shape, in pentagonal columns of basalt, in the Shiant Isles, the property of Lord Seaforth, off the coast of Lewis. The latter shells effervesced powerfully with an acid; which was not the case with the zeolitical concretions under consideration.

Further on, the rocks begin to correspond with those on the opposite side of the island, being red sandstone, surmounted by precipitous cliffs of basalt. Below the highest pinnacle of the mountain, which I take to be directly opposite to the holy man's cave, the red sandstone is vastly more elevated than on the opposite side, and shows its dip to

to be towards north north-weſt, which dip all the columnar ſtrata above reſpect.

This part I take to be the outcrop of the metals on which the columnar ſtrata are ſuperimpoſed; and I ſhall often have occaſion to remark, how little ſuch ſtrata, in compariſon with contiguous ſtrata, deviate from the horizontal plane. Here the ſandſtone ſtrata are of conſiderable altitude; but if we conſider the diſtance they run, before they ſink out of view, and leave nothing viſible but the baſalt which reſts upon them, and which alſo becomes comparatively low, we ſhall be aſtoniſhed at the approach towards horizontality, and great regularity, which diſtinguiſhes theſe from all other ſtrata in the neighbourhood.

Further on, the ſea-beach is encumbered with rude maſſes of baſaltic columns, often quadrangular, but moſtly five ſided, which render the paſſage not only difficult but dangerous. Here the baſis on which the baſalt reſts is concealed from view. The ſolid rocks conſiſt of arenaceous baſalt, in rude columns, arranged *ſtratum ſuper ſtratum;* and though each ſtratum of columns be very lofty, their ſtratification is regular, and their dip nearly as already deſcribed.

Obſerved ſeveral veins of whinſtone interſecting the baſalt. Some of theſe conſiſt of large blocks,

 which

which exhibit a rude approach to the external figure of garnets.

The Bay of Lamlash may be about three miles, in a right line, from its northern to its southern entrance; and at its centre it forms a sort of semicircle, of nearly two miles across, having the Holy Isle on one side, and the vale of Lamlash on the other. The northern wing projects nearly towards north-east, while the southern projects nearly towards south-east, giving to the whole a figure approaching to that of a horse-shoe, which prevents the waves of the ocean from getting in to the interior bay. The two inlets may be about a quarter of a mile in breadth at their mouths, and widen gradually as they approach the central bay. The southern inlet is preferred by mariners, because here there is no danger but what is seen. The northern inlet is equally safe to those who know it: but the tails of rocks we have described as projected from Dun-Fioun, and the gradual decrease of altitude of the rocks on the opposite point of Holy Isle, cause them to extend a considerable way below the sea, before they sink out of the reach of vessels drawing a great depth of water. But to those who know the channel, there is sufficient depth, at both entrances, for the largest ships of the line.

Within,

Within, there is good holding ground; ſufficient depth for the largeſt ſhips; and room enough for the greateſt navy to ride at anchor. In fact, this is one of the beſt harbours in the Frith of Clyde,—if not in the world.

VALE

VALE OF LAMLASH, &c.

FROM the broadest part of the Bay of Lamlash, a beautiful vale extends westward about two miles its greatest breadth being about one mile. A beautiful village, forming a segment of a circle at the head of the bay, has the bay and Holy Island in front, the vale bounded by high hills behind, and in all points of view exhibits the most picturesque scenery in the world. The rising ground on the north of the village, is intersected by belts of Scotch firs, which have not been planted in sufficient density, as they thrive best along the skirts of the rising ground, where they are in larger quantities. In some parts of the vale, streams of water have washed away the soil, leaving rounded stones, among which stunted allers are here and there sprinkled.

In front of the village, Dutchess Ann, who seems to have been a woman of superior capacity, caused a harbour to be built of large quadrangular blocks of sandstone. We may form some idea of the magnitude and solidity of this work, when informed that it cost 2913l. 10s. 5$\frac{4}{12}$d. Sterling, at a time when mason's wages are said to have been

been eightpence, and labourer's wages fourpence per day. It is a great pity this building was allowed to be demolifhed; becaufe its ruins render the village of more difficult accefs from the fea, than if it had never been conftructed; and the numerous veffels which frequent the Bay would find much fecurity, were there a place where they might repair any damage they had received, or might lay in an additional ftock of provifions. Though the conftruction of this harbour did not immediately operate in exciting a traffic here, the local fituation is well adapted for the purpofe; and it is impoffible to fay what effects it might have produced in progrefs of time.

Advancing along the northern boundary of the vale, banks of clay marl, of a red colour, are feen to jut out in many places towards the rifing ground. This ftuff, being wafhed down, feems to have caufed the extraordinary fertility of fome fields lower fituated; and would form an excellent dreffing for thofe tracts of foil whofe chief defect is too great a proportion of fand.

The ftrata along the bay are red fandftone, interfected by numerous veins of whinftone, and often exhibiting a penetration of the whinftone on the cheeks of the vein. Some of thefe veins are what I have called arenaceous bafalt, moftly of a white colour; and fometimes maffes of dark blue whinftone are found inferted in the white bafalt.

Towards

Towards the upper part, the vale ſeparates into two glens, Benleſter and Monymore, which are divided by a high rounded ridge of hill, bearing a ſtrong reſemblance to an immenſe hay ſtack. At the point of this hill ſeveral ſtreams might be made to unite, and afford waterfalls of great power for manufacturing machinery.

In the lower part of Benleſter, which is the northern glen, the ſtrata are compoſed of red, and ſometimes white ſandſtone, interſected by numerous veins of whinſtone, or of whinſtone porphyry. The ſummit of the hills is occupied by precipitous baſaltic cliffs, over which the waters are projected in awfully grand caſcades. Beyond theſe, ſtrata of ſandſtone, alternating with puddingſtone, are divided by cliffs of baſalt, until we reach the ſummit of the iſland.

Here, at a place called Alcrappoch, about four miles from Lamlaſh, a rock of what appears to be primitive puddingſtone, juts out from the ſurrounding maſſes. It is of a bluiſh ſchiſtic ground, very hard, and contains numerous rounded pieces of quartz and baſalt, moſtly of a ſmall ſize. On the weſt of this rock, the burn has expoſed a vein of limeſtone, from twenty to thirty feet broad; though it may be broader, as its weſtern ſide is covered with earth. It is nearly perpendicular, runs towards the north, but inclines, at a very ſmall angle, towards the eaſt. It is compoſed

posed of numerous rounded pieces of indurated chalk, of a white, or yellowish white colour, united together by a sparry cement. Other pieces, and what has sometimes the appearance of subordinate veins, consist of a reddish or blue limestone, exhibiting, in their fracture, numerous shining particles of spar. Where it begins to be covered with earth, it becomes sparry; and there it exhibits some indications of copper. The only circumstance which seems to contradict the opinion I have hazarded, that this is a vein, and that the rocks including it are primary puddingstone, is, that a thin stratum or vein of white argillaceous sandstone, soft but durable, is interposed between the puddingstone and limestone. The puddingstone, also, in some parts, is arranged in massy quadrangular columns, similar to basalt; and I never yet saw columns but they formed strata, and generally of great regularity. The smallness of the concretions too, in the latter rock, their great rotundity, and their difference from those farther on, (which I may afterwards have occasion to describe), seem favourable to the idea of this puddingstone, and the limestone included in it, being strata. But if they be strata, they are of very imperfect formation; and approach nearly to the primary puddingstone beyond them, where veins are perceived, but hardly any apparent stratification.

My object is to record facts, as far as my ob-

servation

ſervation extends, and leave to future Naturaliſts to point out their reaſon and cauſe. The higheſt ſummit of the iſland here, ſouth of the ſchiſtic and granitic mountains, may be about eight hundred feet above the level of the ſea. A tract, or foot-path, from Lamlaſh to the oppoſite ſide of the iſland, paſſes near this rock; and if ever this tract ſhould be converted into a road, (againſt which there is no phyſical obſtacle), this limeſtone may come to be uſeful. Around it are inexhauſtible moſſes, containing peats hardly inferior to coal; and, by proper management, fully adequate to burn the ſtone into lime.

The only burn which here expoſes rocks, runs nearly from the ſouth, in the face of this limeſtone. Theſe rocks are red ſandſtone ſchiſtus, often alternating with red argillaceous ſchiſtus, called *keel* by the people of Scotland; becauſe it is often uſed for drawing lines on boards, &c.; or red ſhiver, in which there is no mixture of ſandſtone. Theſe ſtrata deviate very little from the horizontal plane, though they have a very ſmall inclination towards the north. They are formed into compartments, and interſected at almoſt equal diſtances, by very broad veins of cuneiform and priſmatic whinſtone, compoſed of looſe fragments, and jutting perpendicularly through the ſtrata. Theſe large veins and ſtrata are interſected by other ſmaller veins of whinſtone, running in various directions,

among

among which I diſtinguiſhed ſome veins of white arenaceous baſalt, in which rounded blocks of dark blue whinſtone were included. The large broad veins of cuneiform whinſtone are ſometimes of equal, ſometimes of greater, breadth than the ſtrata interpoſed betwixt them. They are all parallel to each other, and run nearly from ſouth-eaſt to north-weſt. The other veins often meet, and are cut off by each other. Often they terminate without any viſible cauſe; but, when they are ſeen to penetrate either the ſtrata, or the larger veins, they interſect them to their ſummits.

The glen of Monymore projects from the vale of Lamlaſh nearly in a ſouth-weſtern direction. It exhibits nearly the ſame ſort of ſtrata as thoſe deſcribed in Benleſter—red, and ſometimes white ſandſtone, interſected by veins of whinſtone-porphyry, or whinſtone. I obſerved that the ſandſtone contiguous to the veins is often of a white colour, ſhattery, and contains numerous quartzy concretions. Often ſmall veins of this ſandſtone are included between two whinſtone veins. In other caſes, rounded fragments of white ſandſtone are inſerted into the veins, while, on the other hand, fragments of the whinſtone are inſerted in the ſandſtone. In not a few caſes, the whinſtone penetrates the ſandſtone contiguous to it; to which it conveys ſuperior hardneſs, and part of its colour.

Near

Near the fummit of this glen, found feveral large blocks of limeftone, and traced them to a place where the ftrata are covered by ftones and rubbifh. There muft be limeftone not far from this place, though concealed from view.

Paffed over the higheft fummit, and defcended part of Glen Scordel, which runs nearly in the fame direction with Monymore;—ftrata fimilar to thofe defcribed. The tops of the hills are furmounted by ledges of cuneiform or prifmatic bafalt; and in many cafes it affects the columnar form.

Returned by the fummit of Garbin *(rugged hill.)* On the fouth-weftern afcent, the rocks are moftly fatifcent whinftone of a dark colour, approaching to black, arranged in large veins, and exhibiting rounded blocks, imbedded in a foft matter, which is often of a rufty colour. Towards the fummit, this hill is compofed of hard, fhattery, and prifmatic whinftone, or bafalt,* fimilar to fome parts of the rock of Edinburgh caftle, of a blue colour internally, but, by expofure to the air, it affumes a white tegmen. This rock may be about eight hundred feet above the level of the fea. It is already precipitous towards the north and north-eaft; and after water fhall have wafh-
ed

* See Note [M.]

ed the ſofter ſtrata from its ſides, it may come to ſtand detached.

With much difficulty and danger, deſcended by a precipitous burn on the eaſt of Garbin, which runs northward into the Glen of Monymore. The ſtrata are red, and ſometimes white ſandſtone, dipping rapidly in the direction of the burn. They are croſſed by numerous maſſy veins of whinſtone, which cauſe frequent caſcades. Towards the bottom of the burn, ſhattery or priſmatic baſalt; which exhibits a rude and almoſt vertical ſtratification, and extends to the top of Garbin. Thus this rock ſeems only to be an enlargement of ſuch veins as were deſcribed at the ſummit of Benleſter. In both theſe glens, broad compartments of this hard ſhattery whinſtone often occurred; and correſponding cliffs were ſeen on the ſummits of the oppoſite hills. Thus theſe cliffs appear to be veins, of larger ſize, which reſiſt decompoſition better than the materials in the ſmaller veins, and therefore they occupy the ſummits of hills, or of hills approaching to mountains.

Returning to the bottom of the Vale of Lamlaſh, on the ſouth ſide, vaſt ſtrata of pitchſtone jut above the ſurface of the cultivated land. Theſe ſtrata incline towards ſouth-eaſt, and run about a mile towards ſouth-weſt, which is alſo the caſe with the ſtrata of red ſandſtone between which

they are interpofed. The fragments of thefe ftrata form a broad zone along the rifing ground which bounds the vale on the fouth; and the folid ftrata appear again, in large maffes, beyond a burn, towards the rife of the hill. Their colour varies from a faint to a dark bottle-green.

PRO-

PROMONTORY BETWEEN LAMLASH AND WHITING BAY.

THIS promontory exceeds four miles from north to ſouth, and is more than two miles from the ſea to the mountains. Its higheſt part is towards Lamlaſh, where it may be about two hundred feet above the level of the ſea; and it ſlopes ſouthwards to Whiting Bay. A hollow ſeparates it from the hills, which has moſs in the upper part, and is wet and ſwampy lower down. It contains much improveable land, though it is only cultivated partially in the lower parts towards the ſea. The ſoil is generally a reddiſh friable clay in the higher parts: below it is frequently alluvial, and in theſe caſes abounds too much with ſand. Some deep gullies interſect the lower parts, and expoſe banks of red clay marl, generally below a ſandy ſoil.

The ſtrata are moſtly red, and ſometimes white ſandſtone, frequently alternating with red ſhiver. On the ſouthern ſide of Lamlaſh Bay, very fine white ſandſtone occurs. The ſtrata are variouſly interſected by whinſtone veins.

Along the ſhore of Whiting Bay, the ſtrata are much interſected by whinſtone veins, running

in various directions, and sometimes crossing each other, without mixing, or communicating their substances. There is often a mutual penetration of the whinstone and sandstone. Parts of the whinstone also contain nodules of a darker coloured whinstone than the body of the vein.

Glen Ashdale, which discharges its waters into Whiting Bay, is so called on account of numerous ash trees which formerly grew in it. They are now nearly extirpated, and only a few aller bushes left in their place. It runs nearly from east to west.

The dale, especially on its northern side, exhibits numerous banks of red clay marl; though there is also some red clay which is not marl. In many places, the banks form beautiful sloping hollows and declivities, with a southern exposure, which would be well adapted for fruit trees, as they are sheltered towards the north, and have a marly bottom. In several places, the marly banks have pushed out, and fallen down; and where portions of the marly clay have been washed upon sandy soil, the various species of clover, and sweet grasses, are growing with the utmost luxuriance; proving the great efficacy of this marl to improve such soils. In some cases, by the shifting of the banks, the marl is brought to the surface, and forms a very steril soil, which would require an addition of other earths to render it fertile. Where

this has not happened, the ſoil above it is ſuch as the marl would improve.

The ſtrata are ſimilar to thoſe ſo often deſcribed; and it frequently happens, that the veins which interſect them are compoſed of various ſpecies of whinſtone in the ſame vein, ſuch as baſaltic porphyry, fatiſcent whinſtone, and ſteatitical. When a vein is either fatiſcent, or ſteatitical, often the contents are removed, and it ſerves to conduct rills of water into the glen.

When theſe veins are compoſed of hard materials, they ſerve as bones to protect the ſandſtone from the eroſion of water, and always form a caſcade where they croſs the burn.

A vaſt vein of this ſort croſſes the burn where the glen becomes narrow. It is ſurmounted by a ſtratum of rudely columnar arenaceous baſalt, which the water has removed; but which forms ledges of rock at the ſecond elevation of the hills on each ſide. The vein on which the columns reſt, exhibits a perpendicular face of hard ſhattery baſalt, of a blue colour, and ſplit ſo as to reſemble a rude ſtratification, at an angle of about 80°, ſimilar to the baſalt of Garbin. This barrier forms a caſcade more than one hundred feet perpendicular; and when the burn is ſwelled, people may paſs dry between the water and the rock over which it falls.

With ſome difficulty and danger having aſcended this barrier, found another caſcade behind it, more than fifty feet perpendicular, faced by another hard barrier of baſalt. For a conſiderable way backwards, the ſtratum of columnar baſalt formed perpendicular cliffs on the ſide of the burn, and reſted on various and parallel veins of baſalt, which were ſeen croſſing the burn, and were all of a different ſpecies from the columns which reſted upon the veins.

For a great way behind this, the ground is ſomewhat level, and the ſtrata are the uſual red ſandſtone, interſected by various whinſtone veins.

At laſt we came to a vaſt ſtratum of arenaceous baſalt, formed into rude perpendicular columns, and reſting on ſtrata of red ſandſtone, with ſometimes beds of white ſandſtone, or red ſchiſtus, interpoſed. The columnar ſtratum, with thoſe on which it reſted, were almoſt in a horizontal poſition. This ledge of columns forms the ſummit of the mountains on each ſide.

One circumſtance deſerves attention here,—that the firſt mentioned ſtratum of perpendicular columns, which reſts on numerous veins of whinſtone, or baſalt, was no where ſeen to be penetrated by any of theſe veins. Whereas the columns now under conſideration, with the ſtrata on which they reſt, are interſected, to their ſummit, by numerous veins of whinſtone, of various ſpecies;

ties; but many of them are fatifcent, and much decompofed. In one inftance, a fort of red clay fhiver occupies a vein, which a rill of water from the fouth has fcooped out, fo as to form a long perpendicular mine.

Thefe ftrata feem to be continued much further in this direction. But my conductors were averfe to advance any further, on account of numerous ferpents faid to fwarm among the heath and blocks of ftone, warmed by the burning rays of the fun.

After an excurfion towards the fouth, returned over the top of Knocklecarleu, *Hill of Confultation*, fo called becaufe the people are faid to have affembled here, with a view to deliberate when they were invaded by enemies. Defcending towards Whiting Bay, found ledge above ledge of bafaltic rocks, which are either extenfions of the veins defcribed, or continuations of the arenaceous bafalt. Behind each ledge were flat fpaces, or terraces, of land. At one ledge a great vein of pitchftone was feen included between two veins of whinftone; and fome veins of the latter, at the top of certain terraces, contained a mixture of pitchftone. The loweft terrace contains a confiderable extent of land formerly cultivated, but whofe cultivation has been fince abandoned.

The veins which fupport thefe terraces are moftly concealed by earth wafhed from the terraces, which has formed very fteep banks; and the

the veins are only viſible here and there at their ſummits.

South from the inn of Whiting Bay, a bank is expoſed by the river, which had evidently been formed by depoſitions from the river; though it has now cut a lower channel than that which it occupied when the materials of this bank were depoſited.

The firſt and loweſt ſtratum of this bank, and which forms the channel of the burn, is a very weak ſpecies of clay marl, of a browniſh colour, and mixed with rounded ſtones. 2. Strata of rounded ſtones and ſand, concreted, in many parts, apparently by the infiltration of iron and clay, ſo as to form a ſort of pudding and ſandſtone. 3. A ſtratum of moſs about two feet in thickneſs. 4. Concreted ſand and gravel as before. 5. A ſtratum of moſs. 6. Concreted ſand and gravel. 7. Different ſtrata of looſe ſand and gravel up to the ſuperficial ſoil, which is of various depth, and compoſed of a mixture of ſand and vegetable mould.

The moſs is arranged in thin laminæ; contains many fragments of wood, and vegetable impreſſions; and can hardly be diſtinguiſhed from ſome ſpecies of coal ſchiſtus, or blaes. It alſo throws out a copious efforeſcence of alum, and of ſulphate of magneſia.

May

May not this help to illuſtrate the origin of coal, and what are uſually called the coal-metals? In ſome parts of the north Highlands, I obſerved moſſes of conſiderable thickneſs, over which a great depth of ſand had been thrown, either by the wind, or waſhed down by rills of water. In ſome parts, this ſand was concreting into ſtrata of ſandſtone; while the moſs below, in its progreſs of conſolidation, had ſhrunk, leaving cracks, which divided it into rhomboidal pieces, with ſmooth ſurfaces, every way reſembling what is commonly called cubical coal. Were a ſufficient depth of ſand thrown over ſuch moſſes, I doubt not but the one would gradually conſolidate into ſandſtone, the other into coal.

FROM THE DIPPING TO THE STRUEY ROCKS.

THE dipping rocks form the boundary of Whiting Bay towards the ſouth, and project a perpendicular promontory into the ſea, of conſiderable altitude. They conſiſt of numerous ranges of baſaltic columns, which moſtly obſerve a northern direction, forming the land that is interpoſed betwixt them into terraces of various extent. The ſoil upon theſe rocks is moſtly of a dark colour, inclining to ſand; and the extent that is cultivated bears no proportion to the quantity that might profitably be ſubjected to the plough. In many places the ſoil is too thin; and, in others, the baſaltic rocks jut through the ſurface of the land. In ſeveral places, rills of water have expoſed banks of red clay marl, which is well adapted to correct the defects of the ſoil.

Beyond theſe rocks we deſcend into a beautiful plain, which is part of a farm called Kildonan, belonging to the Marquis of Bute. At the lower extremity of this plain, on the ſea-bank, are ſituated the ruins of Kildonan Caſtle, which, when entire, has not been without magnificence.

Beyond Kildonan is ſituated the extenſive vale of Auchinhew, which hangs towards the ſouth; is bounded by the Strucy rocks on the ſouth-weſt; and extends far back to the baſe of Knocklecarleu on the north.

This vale is interſected by numerous deep ravines, formed by ſtreams of water. In ſome places the ſoil is of a deep red colour, and then contains too great a proportion of clay. In moſt caſes it is of a whitiſh red, or browniſh colour, and contains too much ſand; but, in ſuch caſes, the ravines exhibit deep banks of red clay marl, of various, though generally of excellent quality.

Oppoſite to Auchinhew is ſituated the beautiful iſland of Plada, the property of the Marquis of Bute, having a channel of about a mile in breadth interpoſed betwixt it and the Mainland.

The ſea-beach, towards the Dipping Rocks, exhibits ſtrata of red ſandſtone, interſected by numerous veins of whinſtone. The Dipping Rocks riſe abruptly from the ſea. They may be about three hundred feet perpendicular, and are compoſed of rudely columnar baſalt, moſtly of the arenaceous ſpecies, and frequently exhibit ſpecks or ſtreaks of a ruſty colour. In one place the ſea has ſcooped out a very curious natural arch, detached from the body of the rocks. The baſaltic columns are frequently interſected by veins of baſalt, differing in ſpecies from themſelves. Some of

of theſe are fatiſcent whinſtone; ſome contain concretions of zeolite; others of ſpar of lime. Theſe veins interſect the columns to their ſummits.

Here, the eroſion of one of theſe veins has formed a narrow aperture, through which a burn is projected from the ſummit of the rocks; which, when ſwelled by rain, forms a ſuperb caſcade, ſpouting far beyond the baſe of the rocks. This caſcade forms a land-mark to ſeamen, and is by them called *the piſſing mare.*

Further ſouth, the baſaltic columns reſt upon a ſtratum of ſoft white ſandſtone; below which, ſtrata of red and white ſandſtone alternate, until they are concealed from view.

On the north ſide of the plain of Kildonan, large and broad veins of whinſtone have been ſcooped out by the ſea, ſo as to form a hollow through the ſtrata, which is uſed as a harbour for fiſhing boats, and for embarking cattle, ſheep, &c. The ſouth ſide of this harbour exhibits an extenſive plain, very little below high water, and almoſt perfectly horizontal. When the tide has retreated, this plain exhibits a ſort of moſaic work, being divided by cracks into figures generally of five ſides; though there are many irregularities, ſome of which ſeem to have been produced by the agitation of the ſea. Where the ſea has cut into this plain, it is ſeen to be compoſed of ſtrata of baſaltic columns, the uppermoſt ſtratum apparently from

from ſix to eight inches in altitude; the others varying from one to three feet, until they are loſt in the ſea. Theſe columns are not jointed into each other, as happens with the moſt perfect ſtrata of baſaltes; but they are divided, by horizontal planes, into ſtrata of uncommon regularity.

Southward of the ſubmarine plain juſt deſcribed, there are ſeveral lower plains, compoſed of the ſame materials, with thin veins of whinſtone occaſionally jutting above them. Theſe ſeem to have been formed, from the ſea having removed the upper ſtrata; which, in this place, were perhaps leſs compact, and leſs able to endure its attacks, than their more fortunate neighbour towards the north.

The ſea-bank around Kildonan varies in altitude from about twelve to twenty feet. It is moſtly compoſed of ſuch columns as have been deſcribed; in ſome places exhibiting great regularity; but in moſt caſes much confuſion. This baſaltic ſtratum evidently reſts upon thoſe within tide, and probably may have covered them far beyond the extent where they are now viſible. Kildonan ſea-bank forms a ſort of ſemicircle, which can eaſily be accounted for from the expanſe of ſea which breaks upon it from ſouth-eaſt and north-eaſt, and the hardneſs of the ſubmarine ſtrata in front. But though its baſaltic ſtrata evidently extended much further than they now do, they ſeem not to have

been

been able to refift the fea, which has reduced the bank into its prefent form.

Beyond Kildonan, the ftrata refume the qualities fo often defcribed. They are red fandftone, often alternating with white, and much oftener alternating with red fhiver, or fchiftus; fometimes alfo with red or white fandftone fhiver, or fchiftus.

Along the fea-beach numerous whinftone veins interfect thefe ftrata; and thefe appear through their whole extent, though, on the fea-beach, they are better feen than in a glen. Here the veins run in various directions; fometimes they are ziz-zag, fometimes curved; fometimes they crofs each other; and the larger, as far as I obferved, cuts off, or terminates the fmaller.

Near the mill there is a vaft congeries of veins, fome of which ftand like walls above the furface. Among thefe, it would be eafy to conftruct a fafe harbour for fifhing boats. Thefe veins are moftly compofed of wacken, or of wacken porphyry: though fmaller veins interfect or run parallel to the former, compofed of whinftone of various qualities.

In one of thefe veins, which runs parallel to the others, the hard dark blue whinftone is fuddenly cut off by the fatifcent, which decompofes in concentric layers; and exhibits much foft matter, of a dark colour, with numerous hard rounded

ed nodules, furrounded with rufty crufts, intermixed.

Thefe two fpecies of matters, which fill the fame vein, are feparated by a crofs vein running in a very irregular manner, fometimes zig-zag, fometimes curved, and its breadth varying from about one fourth to more than an inch. This crofs vein, which feparates the contents of the great vein, is pitchftone, approaching to obfidian, as black as jet, very brittle, and its fracture concave. At firft infpection, it is not poffible to diftinguifh it from fome fpecies of candle coal, for which I at firft miftook it.

I could not trace this crofs vein beyond the great vein which it interfected. But here the fea has moftly made its inroads into veins of fatifcent whinftone, which are fuddenly terminated by materials, in the fame vein, more able to refift its attacks. In the cafe alluded to, the hard materials were towards the fea, and the foft towards the land; and the latter were fcooped out into hollows, generally lower than the part towards the fea.

I wifh our fiery philofophers, who allege that whinftone veins were projected in a liquid form from the bowels of the earth, would have the goodnefs to explain, how veins, running parallel and contiguous, fhould be filled with matters fo very different in their quatities; but, more particularly,

cularly, how the matter in the ſame vein ſhould be ſuddenly changed; and how a croſs vein, ſo very different in quality from the matters on either ſide of it, ſhould form the line of ſeparation between the very different materials occupying the ſame great vein? To get all this accompliſhed, theſe fiery gentlemen muſt have their great agent reduced to mathematical rules; and heat muſt operate in direct oppoſition to all our experience of its effects.

Among theſe wacken veins, there are ſome veins of whinſtone, which ſtand above the ſurface like perpendicular walls, and their parts exhibit a rude approach to the cryſtallization of the garnet. Some of theſe latter veins continue their progreſs through the ſtrata which compoſe the ſea-bank; and are ſeen ſometimes in great magnitude, croſſing the burn which runs paſt the mill of Auchinhew, oppoſite to Plada.

On ſcrambling up this burn, found ſuch ſtrata as have been deſcribed; and in many ſtrata of red and white ſandſtone, or clay ſhiver, rounded nodules of limeſtone, ſome white, ſome red, and ſome variegated with both colours, of various ſizes, and arranged in regular beds, or interſperſed among the ſhiver.

Tracing this burn to the ſecondary mountains from which it flows, we find that, near its deſcent from theſe, having formed a caſcade, it has ſcooped

ed out a horrible chafm, and has expofed a very magnificent difplay of the ftrata.

After examining thefe below, and fcrambling to their fummit, I fhall begin their defcription with the ftrata on the north fide, a confiderable way below the cafcade, where they are expofed for more than three hundred feet perpendicular.

There, the ftrata which rife above the burn confift of very thick beds of red fchiftus and fhiver; in the compofition of which, fometimes clay, fometimes foft fandftone, predominates; and the fame ftratum often contains confufed mixtures of both thefe ingredients. The thick ftrata now defcribed often alternate with ftratulæ of red, and fometimes white fandftone.

Above the higheft red ftratum, there is a ftratum of white fandftone. Upon this refts a very thick ftratum of bafalt, in pretty regular columns, moftly of five fides, and exhibiting zeolitical concretions. Upon this, again, refts a confufed ftratum of bafalt, though it affects the columnar form. Above this, an irregular ftratum of white fandftone. Upon this refts a ftratum of dark-coloured columnar bafalt. Next, arenaceous bafalt, of a whitifh colour. Above that, dark columnar, fimilar to the former. Above all, a fhivery fort of fandftone.

The columns of bafalt ftand perpendicular; and the three laft mentioned ftrata of them can be

diſtinguiſhed, by difference of colour, from a great diſtance. The three ſtrata are divided, by perpendicular cracks, into columns of five ſides; and poſſeſſing conſiderable regularity; ſo that the whole ſeries of ſtrata form only one column; that is, the perpendicular cracks divide the three ſtrata into columns from top to bottom. But the columnar ſtrata themſelves are ſeparated by horizontal cracks, in ſome parts ſcarcely viſible, interſecting them horizontally, according with the lines of their colour; and thus forming them into three ſeparate ſtrata.

After ſcrambling over broken columns in the channel of the burn, with great difficulty and danger, I reached the fall of Eſſiemore, (*Great Fall*, as I was told.) This fall, or caſcade, much exceeds a hundred feet perpendicular. It flows over the laſt mentioned ſtrata of baſalt, which have prevented it from ſcooping a deep channel above; though it has made horrid havock with the ſofter ſtrata below. A broad whinſtone vein, compoſed chiefly of dark-coloured, but hard and rounded maſſes, immerſed in ſofter matter of the ſame colour, and both exhibiting the ſame qualities, forms the perpendicular face of the fall. This vein penetrates ſuch ſtrata as I have deſcribed; and when it approaches the ſtrata of baſaltes, it divides into two branches, like the letter V. At the junction with the baſaltic ſtrata, it is wholly

cut

cut off. Though numerous veins penetrated the ſtrata in the lower parts of the country, this is the only vein I obſerved penetrating the ſtrata now deſcribed, or which did not interſect the ſtrata to their ſummit.

The ſouth ſide of the chaſm below the caſcade, exhibits a perpendicular wall of great altitude, being a continuation of the three ſtrata of baſalt already deſcribed on the north ſide. The only difference is, that the ſtratum of white ſandſtone, on which the columns reſt, is of much greater thickneſs than the ſame ſtratum on the north ſide of the chaſm; though the eye can diſcern no difference in the thickneſs of the ſtrata of baſalt on either ſide.

On the ſouth ſide, the white ſandſtone is the only ſtratum viſible below the columns, thoſe below being covered by fragments. It reſiſts all attacks of the weather; is of very fine grain, very ſoft, and eaſily cut with the knife.

Below the fall, the burn has undermined the ſofter ſtrata, deſcribed as viſible on the north ſide, below this range of columns. The effect of this has been, the ſcooping out the horrible chaſm alluded to, and the fall of immenſe maſſes of columns. Theſe fallen columns form two ſeparate hills of columns, with their ſummits moſtly pointed towards the ſouth, and facing the caſcade. Between the hills are many columns, ſcattered with the

the utmoſt irregularity. Theſe muſt have been ſplit off by froſt, or have fallen individually; but the hills of columns muſt have been undermined by the burn, and then have ſlid down to their preſent poſition, in maſs.

On tracing the country backwards, almoſt to its higheſt elevation, I found ſhattery priſmatic whinſtone, often forming blotches, and ſometimes tumuli, or little hills. In ſome places it ſeemed to reſt upon the ſandſtone deſcribed as forming the roof of the ſtrata already detailed; in others, it ſeemed to be the ſummit of whinſtone veins. But as ſtreams of water, here ſluggiſh, afforded no opportunity of aſcertaining this point, I ſhall leave it where I found it.

I may venture to ſtate that, in a particular poſition, with a vivid ſun at my back, and the caſcade of Eſſiemore in front, I enjoyed a beautiful iris, which was a perfect circle; and, by varying my poſition, it varied from a circle, and faſhioned its drapery, in the lower parts, ſo as to inveſt the ſtones in the chaſm below the caſcade. This phenomenon was produced from the refraction of the rays of light, by the particles of water, or ſpray, projected from the caſcade.

Here, the cautious obſerver muſt be ſtruck with the remarkable horizontality of the ſtrata I have attempted to deſcribe. In the lower grounds the ſtrata dip with various, and always form conſiderable,

ſiderable, angles with the horizontal plane. But here the ſtrata are almoſt perfectly horizontal; and, with the utmoſt vigilance, I could only detect a very gentle riſe in the ſtrata towards the north-eaſt.

At a ſmall caſcade (now dry) which falls over the rocks, forming the ſea-bank, ſouthward of Auchinhew burn, there is a conſiderable congeries of ſtalagmites, and petrifactions of lime. A hill has been formed by the fall of theſe ſubſtances from the face of the rock, on which they are formed. Were this hill dug into, it might furniſh a conſiderable maſs of theſe ſtalagmites and petrifactions, which yield excellent lime. The face of the rock, through a conſiderable extent, exhibits a calcareous incruſtation, which makes it look like limeſtone.

This fact indicates a conſiderable ſtratum of limeſtone, concealed ſomewhere behind; from which the matter compoſing theſe incruſtations, &c. had been conveyed, by ſolution, in exceſs of carbonic acid, and afterwards depoſited, when the exceſs of acid, which cauſed the ſolution, was evaporated by expoſure to air. But though I climbed the bank, and endeavoured to find the ſtratum from which theſe ſtalagmites, &c. were waſhed, I did not ſucceed, the ſtrata being here concealed by the ſoil.

Still further fouth, and near the rife of the Struey Rocks, a confiderable burn has fcooped out a narrow and dark chafm in the rocks which form the fea-bank, in the back ground of which it forms a very high and perpendicular cafcade. This cafcade is called *Levencorrach*, or *Black Dog's Fall*.

Tracing this burn to the mountains from which it defcends, found a more grand difplay of the ftrata than thofe defcribed towards the north. At Efcoom (*Narrow Fall*), the water has fcooped out a chafm, through the foft ftrata, of feveral hundred feet perpendicular, in the bofom of which it forms a cafcade more than a hundred feet perpendicular.

Thefe ftrata confift of fandftone, red fhiver, indurated whitifh blue clay, with nodules of limeftone interfperfed. The cafcade is projected from a pavement of hard blue bafalt, whofe frefh fracture exhibits fmall fparkling points. This bafalt forms a regular ftratum, about three feet in thicknefs; and it is fubdivided, by vertical fiffures, into columns. The bafalt has red fhiver both above and below it; and thefe fofter ftrata are continued to the top of the mountain, where they are covered by a range of rude bafaltic columns.

Numerous bafaltic veins penetrate the foft ftrata below; but I did not obferve any of them rife above the ftratum from which the cafcade is projected.

jected. These ſtrata ſcarcely deviate from the horizontal level.

On climbing the ſteep ſhoulder of the hill, on the ſouth ſide of the caſcade, found an extenſive ſwamp behind, which has formerly been a deep lake, but has been drained, in conſequence of the burn having ſcooped out its preſent deep channel.

The ſummit of the iſland, here, is occupied by blotches, or jutting rocks, of rudely columnar baſalt, which reſt upon ſandſtone. A high range of baſaltic columns runs ſouthward from this ſummit to the ſea, and forms the eaſtern face of the Struey Rocks. This range, where its baſe is viſible, is alſo ſeen to reſt upon ſandſtone, and ſuch ſtrata as have been deſcribed, which are here inclined towards the ſouth.

The iſland of Plada, contiguous to this diſtrict, is about a mile from the neareſt point of Arran. It is a low and flat iſland, and contains about ten acres of excellent paſture. An elegant lighthouſe has been conſtructed upon it, conſiſting of reflecting lamps, which are kept in excellent order.

The whole iſland conſiſts of a ſtratum of baſaltic columns, moſtly of the arenaceous ſpecies. On the eaſt ſide, theſe columns are ſeen to reſt upon white ſandſtone. This, again, reſts upon numerous ſtratulæ of limeſtone, conſiſting of rounded blocks, imbedded in red, or white calcareous ſhiver, or marl. Theſe ſtrata are not ſeen percep-

tibly to deviate from the horizontal plane. They are interfected by numerous veins of whinftone of various fpecies, which fometimes, though feldom, are alfo feen to interfect the columnar ftratum of bafalt to its fummit.

STRUEY ROCKS, &c.

AMONG the Struey Rocks there is a confiderable hollow, where fome farms are fituated; but much more land might be gained than is actually cultivated.

Advancing along the fea-beach, thefe rocks prefent bold cliffs, of various altitude, but fome from four to five hundred feet perpendicular.

Thefe cliffs are compofed of bafalt, in fome places exhibiting columns of confiderable regularity, moftly pentagonal; in others a confufed mafs; and in other parts the perpendicular face of the rock is variegated by vertical cracks, which fhew a tendency towards the columnar form. The columns are dark blue; or whitifh, when of the arenaceous fpecies. Both frequently exhibit numerous round concretions of zeolite; and the confufed bafalt often exhibits concretions of prynnite, or filicious zeolite. The dark blue columns fometimes affume a white cruft; and in their interior fracture exhibit cryftals of fell-fpar as black as jet. But what ftruck me moft, were pieces of flate, of a dark blue colour, and of feveral inches area, fticking in fome of the arenaceous columns. This

This ſeems to confirm an opinion the late Dr Walker entertained, of the identity of baſalt with ſchiſtus, or ſlate; and that the former had been formed from matter waſhed off from the latter, and afterwards depoſited.

Theſe rocks are interſected to their ſummits by ſeveral veins of whinſtone, of a different colour and ſpecies from themſelves.

In a place where the rock forms a receſs, one of theſe veins appears not a little remarkable, from its figure, and the conſequences which ſeem to reſult from it. Its figure is that of a perfect wedge, or elongated iſoſceles triangle, whoſe baſe is at the ſummit of the rock; and it terminates in a ſharp point, or edge, about fifteen feet above the bottom of the rock. The ſides of this vein are whitiſh arenaceous baſalt, with no perceptible tendency towards a columnar form, and are very regular. Part of the vein, at its ſummit, is empty, the matter that filled it having been decompoſed and carried off. The firſt matter that appears is fatiſcent whinſtone, conſiſting of rounded blocks, diſſeminated among ſoft matter. Below this, the whole vein, to its bottom, is filled with pieces of hard and dark blue whinſtone, of equal thickneſs, and built upon each other with all the regularity of the moſt perfect ſtratification. Theſe pieces have their ends cut off, ſo as to fit exactly the ſides

ſides of the vein; and the whole ſeries of pieces exactly fills up the iſoceles triangle, or wedge.

The concluſion that ſeems to reſult from this fact, is, that baſaltic veins do not deſcend to an unlimited depth through the ſtrata of the earth; and that they have been formed from matter conveyed into cracks and fiſſures of the ſtrata from above, in place of being projected up through the ſtrata in a liquid form, from a great depth below, according to the igneous theory of their origin.

To the ſouth of this place, the ſea has ſcooped a vaſt cave, called the Black Cave, into a large vein of ſoft wacken; the mouth of which may be about eighty feet high; its breadth about forty feet; and its length, until it is encumbered with large ſtones, may be about a hundred feet. The ſtones which encumber the bottom of the cave, have fallen down from the rocks behind, where an opening, like a pit, riſes to the air above. The ſides of the cave are ſupported by rude baſaltic columns.

Overpowered with the fatigue of ſcrambling along the rugged ſea-beach, where not a breath of air was ſtirring, and the ſun ſhot forth all his rays, his heat augmented by reflection from the rocks; while I reſted my wearied limbs in the bottom of this cavern, the ſea appeared before me as ſmooth as a mirror; and the ſuperb rock of Ailſa was directly

rectly in front, like a vaſt balloon ſeen through an avenue; while a column of white miſt, hovering on his ſummit, exhibited a lively repreſentation of a volcanic eruption.

Here I began to meditate how a man might contrive to live in this place, ſecluded from human ſociety, and converſing only with the ſublime of nature, or with nature's great Author. The banks on either hand of theſe rocks, might furniſh him with abundance of nuts, of berries, of plants and roots, to gratify his hunger. The ſea would be his fiſh-pond, where, by an eaſy contrivance, he might take what quantities of the finny tribes were neceſſary for his ſubſiſtence, and repay the tribute they yielded him, by furniſhing them with abundant food. His clothes he might weave of the bark of trees, or of the benty graſſes, which grow upon the ſea-beach, into which, like the South Sea iſlanders, he might entwine the feathers of ſea-fowls; which would not only ſhelter him from cold, but defend him from rain. His bed would be moſs and leaves, in ſome convenient ſhelve of the rocks; and his drink the pure water which trickles from the bottom of the cavern. Here, dead to ambition, and unannoyed by the folly of mankind, our philoſopher might live only to improve his mind, and to prepare himſelf for heaven.—But while occupied with theſe cogitations,

tions, I figured fome fuch ftorm as had fcooped out this cavern, which would blow our philofopher and his fpeculations up through the pit that defcends from the furface behind. The conclufion was, that fociety is preferable to folitude; and that it is our duty to do good to mankind, even though, inftead of duly appreciating our fervices, they fhould mifreprefent and counteract our good intentions.

Contiguous to this cave, granitic porphyry * commences, and occupies the fea-beach, until it is intercepted by fandftone, and other foft ftrata. In fact, it forms a range of rocks, of various altitude, which runs acrofs the country, nearly north by weft, until it is interfected by the fecondary mountains.

That my reafon may appear for diftinguifhing this variety of porphyry, fo different from all others I have obferved, by the name of *granitic*, I fhall attempt a general defcription of it; and fhall note the deviations from its general character as they may happen to occur.

Sometimes it is arranged in huge blocks, of various fize, and exhibiting great irregularity in their pofition; but always exhibiting, or affecting, a quadrangular form. Sometimes arranged in horizontal ftrata, confifting of a great number of quadrangular

* See Note [N.]

quadrangular columns of the fame altitude. Sometimes, like fmall grained granite, it forms a confufed irregular mafs; and, in this cafe, its concretions are often fmall, and its fell-fpar frequently decayed.

Its fubftramen, or ground, is arenaceous, apparently granitic fand concreted, in which are inferted numerous cryftals of fell-fpar and quartz. The colour of the fubftramen various; ftrikes fire with fteel; very hard; refifts the chifel; its fracture, in the ground, inclining to the plane, but rough.

Its concretions are fell-fpar and quartz, of various, but often of confiderable fize. Thefe cryftals have their angles worn off, and are always more or lefs rounded. The fell-fpar commonly breaks on the fame plane with the ground in which it is inferted, and is commonly of a dull white colour, without any of the fparkling appearance exhibited by the frefh fracture of the fell-fpar in granite; fhewing that it had been water-worn, and expofed to decompofition, before it entered into its prefent combination. The quartz are commonly of a fmoky colour, fuch as abound in the granitic mountains of Arran. They have evidently been perfect cryftals, but have had their angles worn off by attrition in water. After fracturing the ftone, their ends often ftick out beyond the ground, leaving correfponding hollows on the oppofite chip.

The

The primary soil upon these rocks is commonly thin, and every way similar to that upon *granite*. It is moorish, or mossy, at the surface; white below; and the subsoil exhibits granitic sand, often interspersed with fell-spars and quartz, such as they appear in the original rock. It is often encumbered with detached masses of the rock; and frequently the solid rock juts through its surface.

This variety of porphyry differs so much from every other species of porphyry I have yet seen, that, in order to distinguish it, I have called it *granitic porphyry*, because it differs in no respect from granite, except that it has a substramen; of which granite has none that is visible. The rounded figure of its concretions, shews that it once had been granite, making a part of the granitic mountains of Arran; but the granite having the adhesion of its crystals destroyed, they were conveyed into their present situation by attrition in water, and afterwards reconsolidated into rocks not less hard than granite.

Immediately contiguous to the Black Cave, granitic porphyry commences, and occupies the sea-beach for a considerable extent. It generally affects the columnar form; but is frequently arranged in huge masses, without any apparent regularity. It is frequently intersected, from top to bottom, by whinstone veins. Its concretions are of various, and sometimes of considerable size.

Often

Often the fubftramen, or ground, exhibits a brown, or rufty appearance.

But what is ftill more fingular, though not mentioned before, a great part of the bafaltic rocks already defcribed, is covered with granitic porphyry, moftly arranged in rude maffes, like that under confideration. In thefe cafes, the veins which interfect the bafalt, interfect alfo the porphyry to its fummit.

This may throw fome light on the fucceffive formation of thefe rocks. Firft, the fandftone ftrata on which the bafalt refts, though they are dipped from view on the fea-beach, had been formed. Over thefe the bafaltic ftrata had been thrown; and above all the porphyritic. The gradual confolidation of thefe ftrata has left cracks, or chafms, which have afterwards been filled by whinftone veins.

SOUTH

SOUTH-END.

FROM the Struey Rocks to the Brown Hills, there is an extent of more than ten miles. Here the mountains towards the north-eaſt retire to an almoſt imperceptible diſtance; and, allowing for ravines, and other obſtacles, there are much more than 20,000 acres, either cultivated, or capable of being cultivated with profit.

The foil here is generally ſuch as I have frequently deſcribed. It is moſtly a browniſh, or reddiſh clay. Where of a deep red, it is not ſo good, though capable of correction. In many caſes ſand predominates; but, in ſuch caſes, the ravines expoſe immenſe banks of reddiſh clay marl, of various, and often of good quality. Where alluvial ſoil has not been conveyed over granitic porphyry, the primary ſoil is ſuch as I have attempted to deſcribe.

The general character of the ſtrata is red, and ſometimes white, ſandſtone, or puddingſtone, often including large beds of red, and ſometimes white, clay ſhiver, or ſandſtone ſhiver. Theſe ſtrata are variouſly interſected by whinſtone veins.

Along the ſea-bank, from where the granitic porphyry terminates, to the brown rocks, ſand-

ftone ftrata, moftly of a red colour, and alternating with fhiver, prevail. In the latter are many ftratulæ, and rounded nodules of limeftone, in beds, or interfperfed; but none which feem to merit attention. Frequently, alfo, ftratulæ or nodules of argillaceous ironftone, of a red colour, though few of great purity, are vifible.

In one place, the red ftrata are interfected by a compartment of pure white fandftone, of a very fine grain, and fufceptible of the higheft polifh of which that ftone is capable. This compartment occupies the fea-beach, which is here dangerous to be approached by veffels; but if the exportation of this ftone were found profitable, a harbour might be formed by digging it below tide-mark. What was taken out of the rut intended for a harbour, would more than repay the expenfe of its excavation.

Further on, where the fea-bank is bold and lofty, a great mafs of calcareous incruftations and petrifactions, are feen adhering to the face of the rock, and numerous fragments of thefe fubftances have rolled down to the fea-beach. A large green hill feems loaded with powdery calcareous matter, and with fragments which have fallen from the rock above. The powdery matter might be ufed as marl; and the fragments might be burnt into lime of very fuperior quality.

This

This calcareous matter muſt be conveyed by ſolution from ſome limeſtone rock ſituated ſomewhere behind: but after climbing the bank, I ſaw that the ſtrata were covered with cultivated ſoil; and no limeſtone was viſible in any of the contiguous burns.

Along this coaſt the whinſtone veins are very numerous. They generally penetrate the ſandſtone ſtrata on each ſide, or form very hard veins of ſandſtone, running parallel to them, which are ſeparated from the horizontal ſtrata by fiſſures, or cracks.

The moſt remarkable of theſe veins are at Cletiemore, below the farm of Sliddery. Here they are ſeen to jut above the ſurface, like perpendicular walls; and form a harbour for ſmall veſſels, which might eaſily be rendered commodious.

The harbour is formed by two veins, the one of baſalt, the other of whinſtone. The baſaltic vein runs nearly from eaſt to weſt, and interſects the other, which runs nearly from north to ſouth, at right angles. The baſaltic vein is compoſed of four ſided columns, the ſides from four to five inches, laid perfectly horizontal, in the direction from north to ſouth, at right angles to the direction of the vein. This vein, or the length of the quadrangular pieces of which it is compoſed, may be about twelve feet in thickneſs. The columns (if columns they can be called when in a hori-

zontal poſition) adhere to each other, the angle of one exactly fitting the angle formed by the junction of two others; and their ends form a perpendicular wall on each ſide, which defends the ſmall bay, or harbour within, from the violence of the ſea. They have every appearance of quadrangular ſpars of wood built up in a wood-yard. A narrow paſſage cut through this vein, admits veſſels into the harbour.

The matter of which this vein is compoſed, has externally the gloſſy appearance of pitchſtone; but internally it is found to be hard dark blue baſalt; its freſh fracture exhibiting numerous ſparkling points.

The vein from north to ſouth is a coarſe grained whinſtone, containing numerous concretions, of various ſubſtances, and is more than thirty feet in thickneſs. On the beach, it firſt becomes curved, and is ſoon cut entirely off by a vein from north north-weſt, which forms a high wall upon the ſea-beach.

The baſaltic vein cuts through the one from north to ſouth, without any communication of ſubſtance; only, on the north ſide of it, there is a ſmall cruſt, or vein, of the ſame matter as the whinſtone vein, interpoſed betwixt them. On the ſouth ſide, there is interpoſed betwixt the baſaltic and whinſtone veins, a vein of about a foot in breadth, compoſed of rounded nodules, of the ſame

materials

materials with the interfected vein, faftened in a cement of the fame; though the cement is fofter than the nodules. In fact, this is a true vein of whinftone pudding, running parallel to the bafaltic, or interfecting vein.

Paffing on until we reach the fea-beach below the farm of Corrychrevy, we there find a natural harbour, called Haddock Port, defended (as I was told) by a bank called the *Iron Ifland*, which was faid to be uncovered at half tide; though the tide happened to be too high, all the times I was there, to render this ifland vifible. Between the ifland and the natural harbour, there is faid to be a deep channel, with good anchoring ground, where veffels may ride in perfect fafety.

This is the fouth-weftern extremity of Arran, being the point oppofite to its north-eaftern extremity; and if a good harbour were conftructed here, it would tend much to improve the moft improveable diftrict of Arran.

Beyond this harbour there is an extenfive flat, very little elevated above high tide. It is a fwamp, and ufed only for cutting reeds, and other aquatic graffes, to prevent cattle from ftarving during winter. Were this fwamp only drained, which might be done at a fmall expenfe, it would throw up graffes of great value; or might be fubjected to the plough.

On the sea-bank north of the harbour, there is a round detached hill, very steep on all sides and connected with the mainland by a narrow neck. This hill is called *Torchastel* (*Castle Hill.*) On its summit, there is a circular foundation of an ancient Danish fort, composed of large stones without cement. There is also an outwork, of the same materials, to defend the narrow entrance from the land.

From the superstitious veneration the people shewed for this place;—their notions of its being inhabited by fairies and spirits, beings whom they esteemed wholly inclined to mischief, though no one could condescend on any specific harm which these animals had done;—from the circumstance, that every place, where religious rites were performed before the introduction of Christianity, continues still to be an object of fear and apprehension, from Arran to the Orkneys,—I inferred that this hill was not only a fort, but also a place where the Scandinavians, who possessed this island, worshipped their savage and brutish god Tor, or Thor.

The word *Tor*, in Gaëlic, means something that rises boldly upwards; and is applied to many hills, throughout the Highlands, which are rounded, precipitous, and resemble a heap of hay. I suspect the word is not indigenous in Gaëlic, but to have been derived from the Scandinavian language, and to be now applied only to those hills

where

where these people worshipped their worse than brute of a God.

In the ravines contiguous to this fort, there are vast strata of florid red clay, well adapted for making bricks, and all the coarser earthen utensils, of superior beauty.

On reaching the solid rock at the base of the Brown-hills, (their Gaelic name means *Brown-head*, from their projection into the sea), I found them composed of granitic porphyry. It sometimes affects a columnar form, and is composed of blocks, of various dimensions, many of which are very large, though they are of all magnitudes; and all are either quadrangular, or affect the quadrangular form. In other places, this stone is arranged in strata, of various thickness, which rise towards the north at an angle of about 80°. Other parts are composed of vast masses, which seem to form veins through the stratified parts; and are every way similar to those blocks described as intersecting the stratified granite. Some of this stone has assumed a yellowish red tegmen, or crust, which has occasioned the name given to the hills. But the recent fracture discovers no difference of colour between those which have a brown, and those which have a grey tegmen.

Many parts of this stone exhibit few or no particles of fellspar; but display numerous smoaky crystals of quartz, often of considerable size, in-

ferted in a jaſpidean ground, and always having their points and angles worn off.

This ſtone ſeems very durable; and, furniſhing quadrangular blocks of various ſize, it ſeems well calculated for the conſtruction of piers and harbours.

Mr Jamieſon, apparently judging from ſtones he found at the mouths of burns, p. 132, ſays, ' The hills back from the ſhore are formed of ' *ſcenite*, which is very probably penetrated with ' veins of baſalt, as that at the head of Glen-' Cloy.'

Under *the hills*, Mr Jamieſon ſeems to include the *Brown-hills*; but, though I walked over their ſummits in various directions, and explored moſt of their baſe, I found no other rock than what I have attempted to deſcribe. The ruſty colour on the ſummit of the hill, is produced by the oxygenation of iron in the fellſpar, or rather ground of the ſtone, by the ſame proceſs which occaſions a ruſty appearance in granite. But when either rock is broken to a ſufficient depth, we find no ruſty appearance.

The *Brown-hills* are the only rocks in Arran in which I ſaw no baſaltic veins; and if Mr Jamieſon alludes to other hills, bounding the South-End, I can aſſure him I did not find one ounce of ſyenite in them, except in puddingſtone.

Having

Having defcribed what occurred along the fea-fhore, let us now return, and explore the interior country.

The diftrict of South-End rifes gradually from the fea-fhore to the fecondary mountains, through an extent of from ten to twelve miles. It may be confidered as a valley included between the Strucy Rocks on the eaft, and the Brown-hills on the weft.

This valley is interfected by two main rivulets, viz. Torlin towards the eaft, and the water of Sliddery towards the weft. Thefe ftreams run nearly parallel to each other, from north-eaft to fouth-weft, and receive numerous tributary ftreams in their progrefs from the fecondary mountains towards the fea. Moft of the other burns, which flow into the fea, are merely mountain torrents, which are dry, except when they are fwelled by exceffive rains. Moft of thefe burns have cut deep chafms, or ravines, in the ftrata; and the main ftreams have frequently formed delightful vallies, though fometimes of fmall extent.

Numerous veins of whinftone interfect the ftrata here; and I muft endeavour to explain the circumftances in which fome of them differ from others, of a fimilar nature, in the ifland.

The moft prominent feature of many of thefe veins, is an impregnation of numerous cryftals of pyrites of iron, which, where of fufficient magnitude

tude to be ſeen, are perfect cubes; and where the magnitude extends to one or two inches, they diſplay cubes inſerted into cubes in a very irregular manner. From the waſhing of aſtringent moſs-water, theſe cryſtals are black externally; and it requires attention to perceive they exiſt in the vein: But when the whinſtone is fractured, they diſcover all the brilliancy of gold, though their luſtre is ſoon tarniſhed by expoſure to air.

Towards the head of Glen Scordel, from which the main branch of the water of Sliddery flows, and in ſeveral other places, there are vaſt veins of whinſtone, interſperſed with innumerable particles of pyrites, which retain their full brilliancy, in ſpite of expoſure to air, and all the aſtringent moſs-water to which they are expoſed. Theſe the people are confident in the belief of being gold; and I confeſs I was a little ſtaggered, until my ingenious friend, Dr Thomſon, by analyzing a ſpecimen, aſſured me that the gold was neither more nor leſs than pyrites of iron.

Other veins diſcover ſmaller, and generally irregular veins of pitchſtone, running parallel, or zig-zagging through them. Sometimes the pitchſtone veins are entirely ſeparated from the whinſtone veins, in which they are included: in other caſes they graduate into each other, ſo that it is impoſſible to ſay where the one begins, or the other terminates. Sometimes you ſee an angular fragment

fragment of pitchſtone inſerted in the whinſtone vein, which mutually graduate into each other. At other times, the fragment of pitchſtone is ſeparated from the whinſtone by planes, ſo that it can be taken out, as a ſtone having no affinity with the whinſtone. Maſſes of whinſtone, of a different ſpecies from the vein, either angular or rounded, are alſo found immerſed in various veins, and either graduating into them, or included, without mutual communication of their ſubſtance.

The colour of theſe veins and patches of pitchſtone, is generally an apple green, though it often exhibits a much darker ſhade. But what ſurprized me moſt, was rounded nodules of pitchſtone, of a jet-black colour, very brittle, their fracture gloſſy and conchoidal, inſerted in veins of pale blue, or grey, whinſtone. The fracture of ſuch nodules has ſince aſſumed a dull green tegmen.

Towards the riſe of the country, I often ſaw broad belts of pitchſtone fragments, including moſt of the varieties formerly deſcribed. Theſe ſhew that large ſtrata, or veins, of this ſtone, exiſt below; though I had not time to trace the ſolid rock.

Towards the upper parts of this diſtrict, there are ſeveral ſtrata of puddingſtone, conſiſting of ſmall rounded pebbles of various ſpecies, ſuch as red quartz, jaſpers, flints, agates, &c. inſerted in a ground of white quartz, which often approaches

to

to calcedony. This ſtone makes the neareſt approach to the true puddingſtone of England, of any I have ſeen in Scotland.

The Water of Torlin, or Lag, exposes ſuch ſtrata as have been frequently deſcribed. About a mile above the pariſh church of Kilmory, there is a ſteep bank, the lower part of which is occupied by red clay and ſandſtone ſhiver. Upon this reſts a regular ſtratum of rudely columnar baſalt; and, upon that, quadrangular columns of granitic porphyry. The laſt has a greyiſh or yellowiſh jaſpidean ſubſtramen, in which numerous concretions, conſiſting of rounded ſmoke-coloured quartz and fellſpars are inſerted. The fellſpars are generally rounded, and often decayed. The concretions are frequently of a conſiderable ſize; are diaphanous; the ſubſtramen opaque; does not obey the knife; fracture uneven; ſplintery.

Beyond this, the ſame ſpecies of ſtone is continued a long way; but it becomes ſhattery, irregular, or obſerves a very rude ſtratification. It is frequently interſected by veins of fatiſcent whinſtone; and its concretions are generally of ſmaller ſize than thoſe in the columns.

The lower hills towards the ſouth end of Arran commence here, and run in the direction deſcribed of the granitic porphyry, on the ſea-beach. Inſtead of going minutely into their deſcription, which might not be underſtood, I ſhall attempt to throw

throw together a few obfervations, which may ferve to characterize their general features.

They often exhibit quadrangular columns jutting up through the thin paring of moffy foil. Often, where the porphyry is not columnar, it is fhattery, and bears the fame refemblance to fand-ftone with fmall-grained granite. In fuch cafes, where the rock has been long expofed to the weather, it has acquired a yellowifh or rufty colour, from the oxygenation of iron in its compofition. But where the fand or fragments of this rock are found in the fubfoil, they are generally white, owing to the moffy acids having diffolved, and carried off the iron in the compofition of the ftone. The fame remark is generally applicable to granitic fand, or fragments, forming a moffy fubfoil. In both cafes, when the fragments are broken into, they generally difcover a yellowifh or rufty nucleus under the white tegmen. The firft, produced by the action of the atmofphere on the ftone, before it was enclofed in a moffy foil; the laft, produced by the acids in the foil having abftracted the iron which occafioned the colour.

Several miles above the rock alluded to, and on the fame river, below Strath-Gael, there is a regular ftratum of the granitic porphyry already defcribed. This ftratum may be about fifteen feet high, is formed into regular quadrangular columns, and refts upon horizontal ftrata of the

fame

fame fpecies, varying in thicknefs from four inches to a foot. The only difference between the columnar ftratum, and thofe on which it refts; is, that the ground of the latter is a foriftic clay, which gives it a bluifh colour; whereas the ground of the columns is granitic fand concreted, fuch as has been defcribed forming the cement of thefe rocks of porphyry. In all other refpects, the concretions in both ftrata, horizontal and columnar, confifting of fellfpar and fmoky quartz, are precifely fimilar to thofe repeatedly defcribed.

One circumftance ftruck me forcibly, *viz.* the remarkable horizontality, both of the ftrata which form the bafe, and of the columnar ftratum which refts upon them.

The hills on each fide, and particularly thofe on the eaft, exhibit range above range of the fame quadrangular columns of porphyry. The fragments which have fallen, enveloped in heath, have formed terraces which generally conceal the bafes of thefe columns from view. But a friendly torrent on the eaft had fwept away the matter which concealed the bafis of the firft columnar range above the one defcribed. Here the porphyritic columns were feen to reft on red clay and fandftone fhiver, arranged in ftratulæ, of which a great depth is expofed. On climbing a fteep rock on the oppofite or weftern fide of the glen, I found the fame ftratum of columns on the fame horizontal

tal level with thoſe laſt deſcribed, and reſting on the ſame materials, though here expoſed to a much greater de th.

We have thus got a baſis, conſiſting of horizontal ſtrata of porphyry, with a ſchiſtic ground. Above theſe, a columnar, and very regular, ſtratum of granitic porphyry. Above that, a ſtratum of great altitude, compoſed of ſtratulæ of clay and ſandſtone ſhiver. Above the latter, a ſteep, columnar, and very regular ſtratum of granitic porphyry.

Although I was not able to trace on what the other ſtrata of porphyry, higher ſituated, reſted; yet, from the terraces they exhibited in front, I am entitled to conclude, that they reſted on the ſame ſtrata of ſandſtone and ſhiver on which thoſe deſcribed reſted.

Thus, we have columnar porphyry reſting on horizontal ſtrata of porphyry; and ſtrata of columnar porphyry, alternating with ſandſtone and ſhiver, to the ſummits of the neighbouring hills.

In ſome places, through the range of theſe hills, beautiful caſcades are formed, by torrents flowing over a barrier compoſed of tall quadrangular colums, which are perfectly perpendicular, and the whole ſtratum apparently horizontal. Though I could not ſee on what theſe ſtrata reſted, they commonly exhibited range riſing above range; and I preſume they may be ſtrata of columnar granitic

nitic porphyry, alternating with fandftone and fhiver, as already defcribed.

On paffing a certain line, fandftone ftrata again commence, interfected by numerous whinftone veins. But, on approaching the fummit of the fecondary mountains, the ftrata are found to be arranged in compartments, confifting of broad ftripes of fhattery whinftone, with fandftone ftrata interpofed betwixt them. Thefe ftripes have every appearance of being large veins, immerfed in the fandftone ftrata. Sometimes the whinftone forms blotches, which occupy the fummits of hills.

Whether the zones of whinftone which interfect the fandftone ftrata, be veins or not, I fhall not take upon me to decide; but in Alfmourac Burn, which flows from the higheft elevation of the Struey Rocks, eaftward from Strath-Gaël, a great zone of this fort of whinftone interfects the fandftone ftrata, and is feen to reft on fandftone and fhiver. The other ftrata are blotches of whinftone, or whinftone and fandftone, arranged in irregular compartments, where the bafe of the whinftone is not feen. But if this be a vein, and it is very like one, though of large fize, it confirms an idea, already expreffed, that whinftone veins do not always defcend to a great depth.

Here are alfo numerous ftratulæ, confifting of rounded nodules of limeftone, imbedded in marly fchiftus. There is alfo a regular ftratum of limeftone

ftone in another place; but unlefs it be found of greater thicknefs towards the dip, it is not worthy of attention.

The hills, or rather fecondary mountains, towards the north of Strath-Gael, in their afcent, exhibit the fame appearances, viz. fandftone and fhiver regularly ftratified, which is often interfected by whinftone veins. Often, alfo, the whinftone forms irregular blotches, fome of which, by the excavations of burns, are feen to reft on fandftone. Not feldom the fandftone is croffed by parallel ftripes of whinftone, fo as to form regular compartments; and in a few cafes, thefe ftripes are feen to be immerfed in, and to reft on fandftone; giving a very lively idea of veins which penetrate, but do not defcend far, into the fandftone.

In the hill above Auchinreach farm, and others contiguous, thefe appearances are confpicuous. This hill is furmounted by a very thick ftratum of granitic porphyry, arranged in quadrangular columns, which reft on red fandftone and fandftone fhiver.

The hills here, efpecially where they approach the primary puddingftone, are interfected by various, and fometimes confiderable veins of fparry limeftone. The limeftone cannot be ufed, becaufe the expenfe of conveying it to land, where it might operate with advantage, would be much

 greater

greater than its value. But theſe veins are often marked with blotches, and ſometimes interſected by venulæ of copper ore.

Whether there be any vein of copper here, worth working, can only be determined by a man who pitches his tent among the mountains, and cannot be aſcertained by one who conſumes moſt of the day in travelling backwards and forwards between his quarters and the ſcene of action, and ſeldom gets home without danger of breaking his neck.

From the ſide of Beninyaran (ſaid to mean *ſpringy moor*, or *hill*), an elevated plain is project-ed towards the ſouth, on which there is an im-menſe circular mound of looſe ſtones. This may have been an encampment, or fort, of the Norwe-gians, when they poſſeſſed the iſland.

In the water of Sliddery, beſides the ſtrata ſo often deſcribed, the only thing remarkable is an extenſive ſtratum of arenaceous baſalt, in moſt places columnar above, but ſhattery and irregular below. The columns are of a greyiſh white co-lour; and many of their ſides exhibit ochreous concentric rings, of a brown colour, exactly ſimi-lar to thoſe which appear in many ſpecies of ſand-ſtone. In ſome places they are regular, like the concentric layers of wood in a tree. In other places they are compreſſed, or contorted; but are always parallel to each other. Obſerved only one vein

vein of whinſtone, which interſects the ſhattery ſtuff below, but does not penetrate the columnar ſtratum above.

At firſt, I miſtook this ſtratum for columnar ſandſtone; but, on obſerving its hardneſs, its mode of fracture, and eſpecially that its fragments ring, or tinkle, when ſtruck with a hammer, or one piece when daſhed againſt another,—I had no heſitation in referring it to that variety of baſalt which I have diſtinguiſhed by the name of arenaceous.

There are ſeveral other ranges of columnar arenaceous baſalt, not only on the hills contiguous to the upper parts of this river, but alſo on the ſides of burns which diſcharge themſelves into it; though theſe ſeem not to deſerve particular attention.

On the bank above this river, in the lower part of Margreeach farm, there is a grave ſuch as Oſſian deſcribes to be the grave of a hero, and reputed here to be the grave of a giant. Of this giant many ſtories are told, which are evidently fabulous; and he is thought to have lived in the times of Fioun, when moſt people were giants.

The grave is marked by two large ſtones, ſtanding perpendicular, the one at the head, and the other at the feet, their diſtance from eaſt to weſt being about thirty feet. The ſides are alſo marked by ſmaller flags, very neatly faſtened in

 the

the earth, their tops pointing outwardly on each ſide, and forming the ſurface of the grave into a parallelogramic area.

A much ſmaller grave, a little below, and marked preciſely in the ſame way, though ſufficient to hold a very tall man (as we modern pigmies eſtimate human dimenſions), is reputed to be the grave of the giant's dog.

The people talked of a man who dug into the giant's grave, and got out a marrow-bone, into the hollow of which he could thruſt down his foot and leg, as if into a boot. But fearing ſome judgment might come upon him for diſturbing the aſhes of the dead, they ſay he replaced the bone where he found it, and reſtored the grave to its original ſtate.

I have ſeen many graves, in various parts of the Highlands, of extraordinary dimenſions, and reputed to be the graves of giants of the Fingalian æra. They always had ſmaller graves at the feet, reputed to contain the hero's dog. It would ſurely be eaſy to dig into ſuch graves, and aſcertain whether they contain bones of more than ordinary ſize.

The only caſe where I ever could obtain credible information of this being attempted, was with reſpect to the grave of one of the Fingalian heroes, on the ſea-beach, at the bottom of Glenelg. This chief of Skye, in croſſing the ſtrait to join Fioun in

in a warlike expedition, is faid to have been drowned, and his body buried where it was caft on fhore. The worthy and refpectable minifter of Glenelg, who fhowed me this grave, affured me, that the gentlemen there, of whom he was one, employed fome of the volunteers, foon after laft war commenced, to dig into this grave, which they found conftructed internally with great art, and penetrable with much difficulty. After much labour, they at laft got out a jaw-bone, which, having its pivots applied below the ears of a gentleman, by far the largeft man then prefent, hung down upon his breaft, and turned clean over his head. A violent thunder ftorm having enfued, raifed much alarm among the people; and they were glad to replace the bone, and reftore the grave to the condition in which they found it.

In what I have ftated, I have anticipated what may be more fully illuftrated, fhould this work be continued. But the laft fact, which I learned upon the fpot, from the moft refpectable authority, feems to evince, that there were men in former times, a few individuals perhaps, who far furpaffed the prefent dimenfions of the human ftature.

With refpect to the grave now under confideration, I fufpect it to have been a long trench, containing the body not of one perfon, but all the bodies of thofe who may have fallen in fome conflict; and that the dog's grave may contain

a dog for each of the perfonages whofe bones are depofited in the other.

Killing their dogs, and burying them near their owners, was a very natural thought for men who fubfifted entirely by hunting, and who believed that the purfuits of a future ftate were to be every way fimilar to thofe which occupied their attention in this.

The old men here have many traditions about Fiûn, and Offian, whom they reprefent as the laft of his race. But as far as I could learn, they rather believe them to have been giants and necromancers, than men of ordinary ftature, and who acquired celebrity by the exertion of their natural powers.

VALE OF SHISKIN, MACHRY, &c.

THE Vale of Shiſkin is bounded on the ſouth-eaſt by the Brown Hills, and is ſeparated from that of Machry by a low and extenſive moor, which includes ſeveral moſſes. The Vale of Shiſkin may be about ſeven miles in length, from the ſea to the termination of the cultivated land in Glenluig; and from the Brown Hills to thoſe north-eaſt from Machry, may be about five miles in breadth, of moſtly level ground. Were all the land that is capable of cultivation in the plains, and along the riſing ſides of the hills, actually ſubjected to the plough, I ſuppoſe that an area of at leaſt twenty-five ſquare miles might be rendered productive.

The Vale of Shiſkin is interſected by a rivulet called the Black Water, which has cut a paſſage to itſelf through a bar of rocks where it joins the ſea. Here it has formed a ſmall harbour for boats, which is the ferrying place from Campbelton in Kintyre, diſtant about twelve miles. Before the water cut this channel through the rock, the vale behind muſt have been an extenſive lake; and in high floods it ſtill overflows conſiderable tracts of

excellent ſoil, compoſed of rich mud that has been waſhed from the hills. It would therefore be proper to lower this bar of rock, which would coſt nothing, as the ſtones might be uſed for fences, or for conſtructing a proper harbour at the mouth of the river, and to ſtraighten and widen its channel, ſo that it may diſcharge the waters with more rapidity.

The principal feeder of this ſtream is the Clachan Burn (*Stony Burn*), which deſcends from the hills behind the village of Shedog, and commits ſad havock on the cultivated land, by frequently altering its courſe, and throwing over it bowlder ſtones. The only probable way of confining this ſtream would be by a broad belt of willows, aſhes, larches, and ſuch trees whoſe roots form a net-work round bowlder ſtones. Theſe would bind the ſtones together, and confine the ſtream to a particular channel.

The only parts cultivated here are fields along the ſides of the valley, which are naturally dry, and have been formed by the alluvion of burns. The ſoil is of various ſhades, from a dark brown to a brick red colour, and is very fertile where not too much encumbered with ſtones. But the wet parts are generally the beſt ſoil, were they properly drained.

The upper parts of the valley are moſtly occupied with moſs, or with a rich ſoil that has been formed

formed by earth washed upon the surface of moss. In some cases, there are very regular and alternate strata of moss and clay, to a considerable depth. In other cases, on putting down a bore in moss links, water spouted up with great violence; which shews that springs have there formed a sort of subterraneous lakes, on which the strata of moss and clay are kept floating.

Having given a general description of this tract of country, we shall next advert to the antiquities which it presents.

The first and most remarkable of these is an immense circular heap of stones, or cairn, situated on an elevated plain, above the sea, in the mouth of the valley. Whether this has been a place of interment or not, I cannot pretend to decide; but the general largeness of the stones seems rather to indicate that this had been a Danish fort, or encampment, of considerable extent. However, the top is a flat area, filled throughout with stones, and leaving no appearance of a mound around it. Contiguous to this cairn, there is an extensive moss, stored with numerous fragments of trees, chiefly oak; which, perhaps, had formerly been a sacred grove, and the cairn an implement of Druidical superstition.

Near the village of Shedog, there is a very large artificial green hill, composed of earth and rounded stones; of a circular form, and having

a

a flat circular area on its top. It is every way fimilar to other artificial hills, called *Laws*, in various parts of the country; and may have either been a place of interment, or a place where the Druids decided controverfies, or promulgated laws.

It appears that St Molios had been induced to quit his cave in Holy Ifland, and had long refided in a little valley, in the mouth of Clachan Glen, where he founded a chapel, and where he died at a very advanced age. His grave is fhewn in the burying ground, being a ftone coffin, covered with a flat ftone, on which the figure of the Saint is not inelegantly cut, in the robes of a mitred Abbot, and having in his hand a lituus, or paftoral ftaff.

On the moor between Shifkin and Machry, many tall obelifks, called Standing Stones, are fcattered; and many more have been broken, or have fallen down. Thefe the people believe to be monuments over the graves of heroes, who fell in a battle fought here by Fingal againft the Norwegians; when, proving victorious, he purfued their broken forces to their fort above Clachland, on the oppofite fide of the ifland, and obliged them to leave Arran.

In one place, there are three vaft ftones ftanding, all of red fandftone. One is about twenty feet above ground. Three other ftones have fallen, or have been broken down; all placed in the periphery

riphery of a circle. One of the broken ſtones is a white ſmall grained granite, which had been nearly formed into two milliſtones, that had been ..oken before they were completed. To the weſt-north-weſt is another very tall ſtone, with broken ſtones in the periphery of a circle, of which it makes a part. I doubt not but the other tall ſtones ſcattered through the moor, may alſo be remains of circles.

From theſe circumſtances, I am inclined to think that theſe ſtones are not monuments over the graves of heroes; but Druidical circles, or places of worſhip, ſuch as are found in various parts of the Highlands and Iſles. There are, however, numerous heaps of ſtones, or ſmall cairns, ſcattered here and there, which may have been collected to commemorate the dead.

We ſhall now attend to the foſſils which this diſtrict preſents to our view.

Walking along the ſea-beach, from the mouth of the black water to the vale of Machry, the ſea-bank becomes cliffy, and is compoſed of arenaceous baſalt, which affects the columnar form, or of ſtrata of red ſandſtone and ſhiver, which are generally arranged in compartments, the baſalt not reſting upon, but cutting off or interſecting the ſandſtone. Numerous whinſtone veins are ſeen within tide-mark; though I did not obſerve any of theſe to penetrate the bank.

Below

Below the farm of Drummoduin, (*back of the hill, or castle*), the sea-beach is encumbered by banks of blowing sand, which has destroyed a considerable extent of land. But on approaching the hill of Drummoduin, a bold and majestic cliff, facing the sea, is presented to our view. A ledge of low rocks, mostly covered by the tide, called *Drummoduin Point*, extends from the south end of this cliff. These are composed of a species of porphyry which has generally a schistic ground, of a pale blue colour. They are intersected by several broad and straight veins of whinstone, mostly of the fatiscent species, which the sea has scooped out, leaving long avenues, in which boats occasionally find shelter.

The cliffs of Drummoduin are mostly composed of basaltic porphyry, arranged in columns which are generally pentagonal. These columns vary in altitude, from about eighty to a hundred feet perpendicular. They rest upon a thin stratum of very hard basalt, of a dark blue colour, which also, in many places, affects a subdivision into small columns. This stratum rests upon a regular stratum of soft white sandstone, of a very fine grain, and easily cut with the chisel. Below this, red sandstone and shiver, with here and there a stratum of white sandstone, alternate, until the base is concealed by the loose stones upon the sea-beach. The greatest height of the columns, with the

the ſtrata on which they reſt, above the ſea, may be about three hundred feet.

On turning round the north-eaſt end of this range of columns, and aſcending to the ſummit, I ſaw that the ſtrata dipped towards north-weſt, and that the columns decreaſed in altitude towards the riſe of the ſtrata. Thus the columns are evidently a ſtratum ſuperimpoſed on other ſtrata, and differing only from the other ſtrata in the matter of which they are compoſed, and in being interſected by vertical fiſſures.

In the ſtructure of theſe columns, there are ſeveral peculiarities which I had not obſerved before in baſaltic porphyry. They exhibit a confuſed mixture of baſaltic and granitic porphyry. In the body of the columns, maſſes of the dark blue baſalt, on which they reſt, are viſible. In other parts, nodules of the ſame, or nearly ſimilar baſalt, more or leſs rounded, are found immerſed in granitic porphyry, of a grey ground, which exhibits dark coloured and rounded quartz, and a few fellſpars rounded, but leſs ſo than the quartz. In other parts, the dark blue baſalt is impregnated with rounded cryſtals of quartz and fellſpar; but this only happens where the baſalt ſeems to form the principal ground of the column, or appears to be intermixed with a granitic ſubſtramen. No veins were ſeen to penetrate theſe columns, or the ſtrata on which they reſt.

The

The afcent to this rock from the land is a deep inclined plane; and it is enclofed by a vaft mound of loofe ftones, forming a fegment of a circle from the perpendicular cliff on one fide to that on the other. It has a gateway in front, on each fide of which are great heaps of ftones, which feem to have been additional works for its defence. This mound includes feveral acres of land, in which are feveral ruins of houfes of loofe ftone, and, were not its name entirely Gaëlic, we might believe it to have been a fortrefs of the Danes when they poffeffed this ifland. Had it a fufficient fupply of water, it might be rendered impregnable, were it of any ufe to fortify fuch a place.

North from Drummoduin, the fea-bank forms a fpacious amphitheatre. The fea-beach is interfected by large and irregular veins of porphyry, with an intermixture of bafalt, which form detached rocks upon the fhore. Beyond thefe, numerous, and moft irregular veins of whinftone, are feen to interfect the ftrata of red fandftone, in every direction.

The fea-bank is compofed of red, and fometimes white, fandftone, with ftrata of red fhiver interpofed, and furmounted by a ftratum of porphyry, which affects the columnar form.

Beyond where the porphyry terminates, irregular ftrata of pitchftone are feen interpofed between thofe of red fandftone. This pitchftone moftly

mostly resembles that at Broddick Wood, being of a dirty green colour, with numerous rusty maculæ interspersed, which seem to be small fellspars decayed. Some of it assumes a yellow tegmen; and one large stratum, of a dirty greenish yellow externally, when broken into, exhibited the colour and fracture of yellow bees wax, though it has since lost its lustre.

On the northern side of the amphitheatre, the pitchstone forms irregular veins, some of which terminate at a small depth. In other cases, irregular veins of whinstone rise to the summit, parts of which are intermixed with, and others are penetrated by pitchstone. In other cases, rounded nodules of basalt, penetrated by pitchstone, are found immersed in the whinstone. These nodules exhibit a greenish white tegmen externally; but internally they are of a glossy black colour.

At the projection near King's Cove, is a vast body of pitchstone, which am uncertain whether it be a vein, or stratum.

North from King's Cove, a vast vein of basaltic porphyry intersects the strata. Beyond this, numerous veins of pitchstone are seen at ebb-tide. In one place two large veins meet, and the one is cut off by the other. In another place, two vast veins cross each other, and are seen, each continuing its direction after crossing; but the point of intersection is concealed by stones and rubbish.

The

The pitchſtone here is of various colours, from apple-green to jet-black. Some of it is yellowiſh, or reddiſh.

We ſhall now return, and explore the King's Cove.

This cavern is ſo called, becauſe Robert Bruce found ſhelter and concealment in it when he was proſcribed, and a price ſet upon his head by the Engliſh monarch. It is alſo univerſally reputed to have been the occaſional reſidence of Fioun,* or Fingal, when he reſorted to Arran for the purpoſe of hunting.

The old people here have many ridiculous ſtories about Fioun and his heroes, which have been tranſmitted, from a remote period, by father to ſon, and in their progreſs becoming more and more extravagant. They believe Fioun and his heroes to have been giants of extraordinary ſize.

They ſay that Fioun made a bridge from Kintyre to this place, over which he could paſs, by a few ſteps, from the one land to the other. I could not exactly aſcertain the number of ſteps neceſſary to

* *Fioun* means fair-haired; *Gaël*, his race or nation. All names were originally nicknames, taken from ſome ſtriking peculiarity of the perſon. The Highlanders ſeldom apply the epithet *Gaël* to Fioun, unleſs you expreſs doubts concerning his extraction. But they often characterize him by the ſurname of MachCoul, from the name of his father.

to crofs a fea of about nine miles. They feemed to vary from fix to twelve. Nor could I learn whether this was a real bridge, or only fuch ftepping ftones as are ufed here for croffing waters.

But, what is efteemed ocular demonftration of the gigantic fize of Fioun, and fufficient to overwhelm the moft obftinate fcepticifm, the hero is faid to have had a fon born to him in the cave; and a ftraight groove is fhewn, cut on the fide of the cave, which is firmly believed to have been the exact length of the child's foot the day after he was born. The groove is more than two feet in length; and, taking the human foot to be one fixth of a man's height, it follows, the child muft have been more than twelve feet high the day after he was born; and, if the parents bore the fame proportion, Fioun muft have been from feventy to eighty feet high, and his wife could fcarcely be lefs than from fifty to fixty; a ftature fo enormous, that they could hardly find ftowage in the cave.

The cave is fcooped out of fine grained white fandftone. A vein of the fame fandftone has ftood perpendicular in the centre, from which the ftrata dip rapidly on each fide, forming the roof into a fort of Gothic arch, to which the vein above ferves the purpofe of a key-ftone. At the back part of the cave, this vein comes down to the bottom, and forms a perpendicular column, with a recefs on each fide. The northern recefs is only a few feet.

The ſouthern is of uncertain extent, being gradually contracted in breadth, and at laſt nearly cloſed by rounded ſtones.

The length of this receſs, as meaſured by footing, is about thirty feet. From pillar in back ground, to mouth of cave, exceeds a hundred feet. Greateſt breadth may be about forty-nine or fifty feet; and greateſt height the ſame.

The mouth has been defended by a rampart of looſe ſtones; and many ſtones are ſcattered through the cave, which ſeem to have been uſed as ſeats. The bottom muſt have been much lower formerly than now, and probably was below the preſent tide mark. On the floor there is much rubbiſh, apparently the aſhes of fires; and parts of the rock are incruſted with ſmoke. There are alſo innumerable bones of ſheep, goats, and other animals. This ſhows that the animals to which theſe bones belonged, had been conſumed here.

On the column there is a figure cut reſembling a two-handed ſword. Some think this was an exact repreſentation of the ſword of Fioun; others of that of Robert Bruce. But they do not advert, that if Fioun was the giant they ſuppoſe him to have been, this ſword would hardly ſerve him as a tooth-pick.

To me it appears to be neither one nor other, but a repreſentation of the croſs. It ſtands upon a rude outline, repreſenting a mountain, probably

Mount

Mount Calvary. On each ſide there is a figure kneeling, and praying towards the croſs. Theſe perſonages ſeem habited like monks, though ſome rude ſcrawls give them a ſort of wings, like angels. It is probable the unpractiſed artiſt meant to combine, in his praying figures, both of theſe characters, in order to impreſs the people with greater veneration for the monks.

The firſt promulgators of Chriſtianity in this country, ſeem to have preferred places already conſecrated, by popular veneration, for public devotion, and inculcating the principles of what was, then, a new religion. During the times of Popery, this cave was very frequently, and is even to this day, occaſionally uſed as a place of worſhip. As the croſs is a conſpicuous implement in the Popiſh religion, it was natural to have it cut at the bottom of the cave, where the prieſt would naturally ſtand, and towards which all eyes would be directed.

The ſides of the cave exhibit innumerable ſmall figures, equally rude, repreſenting dogs chaſing ſtags, and men ſhooting arrows at them. They alſo repreſent goats, ſheep, cattle, and various other animals, though the figures are ſo rude, that it is ſeldom poſſible to aſcertain what they repreſent.

Mr Jamieſon, p. 125, thinks theſe ſcratches were 'made by idle fiſhermen, or ſmugglers.' But,

But, unfortunately, there are no fishermen on this coast, nor is there a safe landing-place for boats near this place. Fishermen would have given us fishes, nets, boats and lines, of which no shadow of representation appears among the figures. With regard to smugglers, they may have occasionally concealed their goods in this cave; but they are not remarkable for leaving memoranda of their business behind them.

The people here beliveve these figures to be representations of various exploits of Fioun, and his heroes in the chase. Those who believe Fioun to have been of ordinary stature, may be in the right; and those who believe him to have been a colossus, are obliged to draw upon his necromancy, to enable him to furnish figures so far below his own dimensions.

As these figures represent only objects connected with the chase, they appear to me to have been made at a remote period, when hunting was the sole employment, and chief source of subsistence.

North of this cave are several smaller caves, which communicate with each other. One of these is called the King's kitchen, another his cellar, his larder, &c. On the south side there is a cave called the King's stable, which contains more area than the royal palace, as the cave of residence is here distinguished. It is scooped out of the solid sandstone; the roof not very high, but

but higher at the mouth than at bottom. Its oppofite fides meet each other at an angle of from 80° to 90°. Of courfe, its mouth is very broad, and muft have fallen, were it not fupported by a pillar, exactly in its centre, on which arches reft from each fide, difplaying a ftriking likenefs to the ruinous arches of a Gothic cathedral. The floor and roof of this cave refemble two fpread fans, not parallel, but widening from their centres.

I felt a holy veneration while exploring the caverns where Bruce had fheltered; not becaufe he was a king, but becaufe he was a patriot, a hero, and an affertor of the independency of his country. Such characters as his ought to be held in everlafting honour. I figured him at every corner, heaving a deep figh over the misfortunes of his country; her people expofed to lawlefs maffacre; her property pillaged, or wantonly deftroyed; her daughters infulted and violated; her nobles either funk in felfifh floth, or bafely purchafing a precarious exiftence by unlimited fubmiffion to her foes. Then his eyes darted fire; he grafped his fword; and vowed, with the help of God, vengeance, and the redrefs of his country's wrongs! I then figured him ftalking about, infenfible of the objects around him, but abforbed in profound thought, and concocting thofe plans by which he ultimately fucceeded, not only in vindicating the independency

independency of his country, but in raising her to an unrivalled pinnacle of glory.

Among all the heroes, robbers, and murderers, which either pollute or embellish the page of history, the characters and actions of Wallace and Bruce are such as the philosopher must approve, and the sincere Christian cannot condemn. They drew not their swords to injure or oppress others, but to defend themselves and their country. Compared with them, your Napoleons, your Charles XIIths, your Timur Becks, your Alexanders, &c. whether they operate with ball and bayonet, by midnight assassination, slow poison, starvation, or tortures; as their sole object is to destroy or to enslave mankind, they ought to hide their diminished heads.

Never did superstitious devotee feel more veneration for the tooth, or *os coccygis*, of a supposed saint, than I for the rocks which Bruce had honoured by his contact, and which had sheltered his adversity. The ground was more than classical—it was holy.

Having noted what occurred along the sea-beach of this district, we shall now return, and examine the hills that bound the vale of Shiskin and Glenluig on the east.

In page 124, Mr Jamieson, speaking of the Clachan Glen, says, 'As the glen winds upwards, the hills become higher, being in all probability composed of *sienite*, penetrated with 'veins

'veins of basalt and porphyry; for we find the 'bed of the burn covered with bowlder stones of 'basalt, porphyry, and *scenite*.'

I found several fragments of syenite, not only in the Clachan-Burn, but in various other burns which flow from these hills. But I was not able to trace a single solid rock of syenite in any of these hills; and always found the fragments in question had been detached from rocks of breccia, or puddingstone.

In other places, Mr Jamieson recommends an examination of the stones upon the sea-shore, as an easy way of ascertaining the composition of the contiguous rocks and mountains. Judging by this criterion, I must have inferred, that a great part of the mountains of Arran, from Whiting Bay round by the south to Loch Ransa, were composed of syenite, intermixed with sparry limestone, because the mouth of every rivulet and creek where boats can land, exhibits great quantities of syenite, with occasional mixtures of sparry limestone. But I soon found that these stones had been brought from the opposite shore of Argyleshire as ballast to boats.

A high conical hill looks down upon the village of Shedog *, whose northern base is washed by

* This village is often called *Shiskin*; but the natives appropriate this name to the vale.

by the Clachan Burn. On afcending the fouth-weft bafe of this hill, thick ftrata of red clay fchiftus are vifible, whofe decompofition has formed a confiderable extent of foil, of a vivid crimfon colour, but infertile. I conceive this clay might be ufed for making bricks, tiles, jars, &c. of furpaffing beauty. The low ridge, between this hill and the Brown Rocks, projects feveral plains from its fides, parts of which are cultivated, though the cultivation might be very much extended. This ridge is moftly compofed of red fandftone and fhiver, interfected by numerous veins of whinftone.

The hill above Shedog is compofed of the fame fpecies of ftrata; but it is furmounted by blotches of fhattery whinftone; on which, where there is any foil, all the moft nutritive graffes grow with the utmoft luxuriancy. This whinftone difcovered numerous concretions of calcareous fpar, either diffeminated through the ftone, or formed in cracks and cavities; from whofe decompofition, perhaps, the nutritive graffes may be accounted for.

The ftrata in Clachan Glen are fimilar to thofe fo often defcribed, viz. red fandftone and fhiver, with numerous beds of white fandftone interpofed. They are only remarkable for their horizontality, and great regularity.

But on reaching the head of the Glen, where the Clachan Burn is confined between fteep rocks,

new

new and unaccountable phenomena prefent themfelves. Very thick ftrata, of red clay and fandy fhiver, alternating with regular beds of fandftone, are croffed, and divided into compartments by very broad veins, or zones, of fhattery whinftone. The pieces of this whinftone are generally of a pyramidal form, though they are frequently a confufed fhattery mafs, without adhefion to each other, and of no determinate figure. They are generally ferruginous on the outfide; but when broken into, feem a confufed mixture of fandftone and bafalt. Thefe compartments of whinftone are immerfed in the fandftone ftrata, having all the appearance of broad veins. But further up, thefe pyramidal veins of bafalt, were not only feen immerfed in the fandftone ftrata, but to reft upon a very thick ftratum of red clay fhiver, fhattery, and of confiderable hardnefs. The upper furface of this ftratum is very regular; and, like all the other ftrata here, its inclination is in the fame direction with, though its angle is fomewhat greater, than the declivity of the burn. This circumftance has caufed its upper part to be expofed for a confiderable extent. From its angle of inclination, I doubt not but it forms the bafis of all the other fhattery veins lower down, which are not cut to a fufficient depth to expofe their bafes to view.

Here, then, we have got what has every appearance of whinftone veins, defcending to no great

great depth, but intercepted by a regular ſtratum of indurated clay.

Theſe main veins are of various dimenſions, from a few feet to more than a hundred; and they are at very unequal diſtances from each other: nor is their continuation on oppoſite ſides of the burn always in the ſame line.

Beſide theſe main veins, numerous other veins, of various ſpecies of whinſtone, interſect not only the ſandſtone ſtrata, but the main veins themſelves, in almoſt every direction.

The latter veins are commonly ſmall, though they are ſometimes of very large dimenſions; and their courſe is generally ſo irregular, that it can hardly be traced.

One large vein of this ſort attracted my notice, where it interſected a main vein of ſhattery and pyramidal whinſtone. It exhibited a confuſed jumble of ſoft ſteatites, intermixed with rounded and harder maſſes of the ſame ſpecies, variegated with rounded nodules of pitchſtone, baſalt, porphyry, ſandſtone, and various other ſtones. In ſome parts of this vein, the ſubſtramen which kept theſe ſtones together, was ſoft fatiſcent whinſtone, of a dark colour.

After paſſing theſe rocks, I aſcended to the ſummit of the hill, on the ſouth ſide of the Clachan Glen, where a very extenſive rock of limeſtone is expoſed to view. It runs in the form of

of a vein in primary puddingſtone, from north-weſt to ſouth-eaſt. In one part it juts above the ſurface in the form of tumuli, or little hills, the upper parts of which exhibit numerous rounded pebbles, conſiſting of quartz, jaſpers, flints, &c. &c. cemented in a ground of indurated chalk. This limeſtone has been quarried in ſeveral places, and is ſeen to be compoſed chiefly of indurated chalk, of a white colour, intermixed with pieces of a bluiſh colour, or with granulated ſpar. One circumſtance is remarkable, that the deeper it is penetrated, the ſilicious pebbles which encumber the ſurface, become ſmaller in ſize, and much leſs frequent than in the upper parts. It ſeems hence to follow, that if the rock were wrought to a ſufficient depth, none of theſe ſilicious ſtones would be found in it; and it might yield lime approaching to abſolute purity.

Beyond where the vein breaks out into hills, it is ſeen to run a long way towards ſouth-eaſt. Here no ſilicious ſtones are ſeen intermixed in it; but it conſiſts of rounded pieces of white chalk, immerſed and cemented in greyiſh chalk, or in granulated ſpar of lime.

The ſummit of theſe hills is primary puddingſtone, from which the ſtrata ſlope in all directions.

A road has been made from the Vale of Shiſkin, up to this limeſtone, which is exceſſively ſteep in many places. A very eaſy deſcent might be found by

by the fouth fide of the hill above Shedog; and the lime would not travel far in this direction, until it reached improveable vallies, embofomed among the hills. This road might alfo throw off a branch to Sliddery, and open a communication between the limeftone and South-End.

Above a very fteep mountain torrent, I obferved a large body of limeftone, of a yellowifh white colour. Its pofition being concealed by rubbifh, I could not afcertain whether it was a vein, or ftratum, though it is probably a ramification from the main vein defcribed.

Returned by the channel of this torrent to the bottom of Clachan Glen. The rocks, through a confiderable depth, were fhattery whinftone, very irregular, and confifting of loofe pieces, being probably a face of fome fuch veins as occurred lower down. Below the whinftone, granitic porphyry occurred, arranged in ftrata of various, but fometimes of confiderable thicknefs; and the ftrata always affecting a fubdivifion into quadrangular blocks, or columns. In other places, the porphyry was very confufed, and exhibited no regular ftratification. In all cafes, the fmoky quartz and fellfpars it contained, feemed very much rounded; and many of the latter were much decompofed.

The burn being here encumbered with bowlder ftones, did not fee on what the porphyry refted; but lower down, the fame rock is feen to reft on red

red ſtrata of ſoft argillaceous ſandſtone, which inclines nearly as the water deſcends. Where the porphyry terminates, ſtrata of arenaceous baſalt, are ſeen to reſt on a ſimilar baſis; only the ſandſtone next the baſalt is white.

The Clachan Glen deſcends nearly from eaſt to weſt, and a track, or footpath, conducts along its northern ſide, acroſs the iſland, to Lamlaſh. In the upper part of the Glen, the ſtrata are moſtly red ſandſtone, interſected by whinſtone veins. The ſummit of the iſland is an extenſive plain, moſtly occupied by peat bog; through which hills, or tumili, of primary puddingſtone, are ſcattered.

Where the peat moſs is cut to the bottom by torrents, numerous fragments of trees are ſeen intermixed, though none of great ſize. This ſhows that wood had formerly grown in this expoſed ſituation, at an elevation of from ſeven to eight hundred feet above the level of the ſea.

Ardbhein riſes above the northern ſummit of the Clachan Glen. It is rounded in every direction, and moſtly covered with ſoil; and ſeems to be the higheſt hill ſouth of the granite mountains. Its ſtrata, where viſible, are ſandſtone and whinſtone.

The rugged channel of Balmichel Burn, ſeparates a detached hill, or rock, from the body of the land, on the ſide of Shiſkin. This hill is compoſed of various ranges of baſalt above, moſtly arenaceous,

arenaceous, with a confufed mafs of fandftone below. Great part of this fandftone is mouldering into fand and earth; and the mafs looks like a fteep bed of fand. But it has ftratulæ, and detached pieces of fandftone, of greater hardnefs; and the whole feems a ftrange intermixture of foft and fatifcent, with hard and filicious, fandftone. The colours are brownifh white, yellowifh white, greyifh white.

Further on, towards the head of the Shifkin Vale, and mouth of Glenluig, the primary puddingftone begins to form the boundary of the vale; and the projections of fandftone ftrata between it and the vale, become lefs extenfive.

The farm of Darineach is fituated upon a promontory, where the Vale of Shifkin terminates, and that of Glenluig commences; and is the laft confiderable projection of the fandftone ftrata, from the puddingftone and other rocks. This farm forms a fort of bay, embofomed among the puddingftone rocks, which jut out towards the plain on each fide of it. The ftrata of the bay (if bay it can be called, which rifes rapidly from the cultivated part below) are moftly red fandftone, interfected by numerous whinftone veins. Alternating with the fandftone, here are feveral ftrata of foft bluifh clay, difcovering numerous micaceous particles; without addition, not apparently capable of being rendered adhefive; and evidently

evidently formed from the decompofition of micaceous fchiftus, or rather, perhaps of flate.

Afcending to the fummit, found this bay of ftrata bounded by two walls of primary puddingftone, one projecting towards the fouth-weft, another towards north north-eaft. No whinftone veins were obferved to penetrate the puddingftone: only, on the fouth-weft boundary, a perpendicular vein of puddingftone, having its ftones fmaller and more rounded, was feen to penetrate the rock from top to bottom, though wideft at top.

At the point where thefe two walls joined, a vein of calcareous puddingftone appeared, which feems to be of great magnitude; though, unlefs the earth were ftripped off, it is impoffible to condefcend upon its extent.

The part expofed to view confifts of rounded nodules of chalk, of a white colour, immerfed in a cement, or ground, of the fame, though of a greyifh colour. Towards the northern fide, where it begins to be covered with earth, angular pieces of bluifh limeftone, or of granular fpar, are cemented by means of fepta of bright fparkling calcareous fpar. Here the vein difcovers very ftrong indications of copper; but, while labouring to explore its contents, fuch a denfe fog commenced, that we were glad to defift, and with the greateft difficulty reached the plain without breaking our necks.

Nature

Nature has furniſhed a very eaſy aſcent for a road to this limeſtone; and, ſhould it ever come to be worked, there is a probability of finding a vein of copper connected with it.

Advancing to the head of Glenluig (*Glen of Calves*), the puddingſtone rocks form bold projections, or rather rounded mountains, on the ſouth ſide of the Glen, while few inſtances occur of ſandſtone ſtrata projected from their baſe. On the north ſide, the caſe is very different. The ſandſtone ſtrata form a gentle acclivity, exhibiting much improveable land with a ſouthern expoſure. Theſe ſtrata are cut off by the puddingſtone rocks; theſe again by the ſchiſtic mountains; and the laſt by the ſtill higher ridge of granite which looks down upon Glen Roſa, and faces Goatfell.

At the head of Glenluig three ſtreams unite, and form the river Machry. One deſcends from the granite mountains, which bound Glen Roſa on the north-eaſt. Another from the head of the Glen, by which the road paſſes to Broddick Bay, which is a continuation of Glenluig, on the eaſt. The third deſcends from the puddingſtone mountains on the ſouth ſouth-eaſt.

Theſe puddingſtone mountains diſcover no ſymptom of regular ſtratification. They exhibit numerous cracks, and ſometimes vacancies, which ſeem to have been produced by their ſhrinking during conſolidation; but bear no reſemblance to the

the consolidation of one stratum above another. These cracks form the rocks into irregular masses of vast size.

No whinstone veins were seen to penetrate these rocks; but in the rugged glen which descends from the south south-east mountains, they were seen to be intersected, from top to bottom, by several large veins of indurated clay, of a bluish colour, discovering numerous micaceous particles, and decomposed fragments of slate. This clay appears to have been derived from the decomposition of micaceous schistus; and to have been washed into gaps, formed by the consolidation, and consequent shrinking, of the pudding-stone rocks.

Another remark deserves attention, that the stones in these rocks are generally of small size; and in that case are very much rounded. When of larger size, they are generally angular, or rounded only at the thickest end.

Great varieties were observed both in the colour and hardness of the substramen. In some cases, it appeared to be concreted granitic or basaltic sand, or micaceous schistus, or all the three irregularly blended. In other cases, particularly on the road towards Broddick Bay, the substramen is either concreted basaltic sand, or soft basaltic matter; and the concretions are generally angular pieces of hard basalt, of a blue colour.

 On

On the ſummit of the rock, which riſes bold and majeſtic above the farm-houſes of Glenluig, towards the ſouth, a very large vein of limeſtone is ſeen to deſcend through the puddingſtone. Only a ſmall part, on its weſtern ſide, is uncovered at its ſummit; but, from the cheeks of puddingſtone on each ſide, and the broad zone of ſweet herbage which deſcends almoſt to the bottom of the mountain, its great breadth is clearly aſcertained. Were the thin, and almoſt perpendicular covering of earth removed, I doubt not but it would be found near the bottom of the mountain, where it is covered by looſe fragments of rock. As this vein is perpendicular, and the rocks on each ſide of it very hard puddingſtone, it may be wrought without any danger of the roof falling in.

Having made theſe general remarks, we beg leave to return, and deſcribe the quality of the vein, as far as it is expoſed to view.

On the weſtern ſide, it conſiſted of rounded blocks of white indurated chalk, immerſed in a cement of the ſame, though of a greeniſh colour, owing to an impregnation of copper. This part appeared to be pure calcareous puddingſtone, without any mixture of ſilicious ſtones. Towards the eaſt, it exhibited a congeries of irregular pieces of limeſtone, of a dull white externally, but, being fractured, diſcovered granulated, and ſparkling ſpar of lime, in a bluiſh ſubſtramen. Theſe pieces

were

were either loofe, or cemented in irregular veins of fpar. Some of thefe veins were of a green colour, and difcovered prominent indications of copper. The latter fymptoms prevailed moft where the vein began to be covered with earth.

It would be eafy to lay open this vein, which exhibits a very flattering profpect of including a vein of copper towards its eaftern fide. If this fhould fail, the expenfe would be amply repaid by the excellent limeftone it would furnifh; and that, too, obtained at a mere trifle of expenfe.

In Glenluig, I obferved two banks of reddifh clay marl, which, though not of the beft quality, would prove highly advantageous to the fandy and gravelly foils, and improveable moffes, in that diftrict.

We fhall now return to the Vale of Machry.

This Vale ftretches along the head of a bay of the fame name, and generally exhibits an open fea-beach. The land is wet in many places; and, in others, is too much encumbered with ftones for tillage; but would anfwer well for feveral fpecies of trees. The river Machry has cut a deep channel through red fandftone in feveral places; and its mouth, though very incommodious, is ufed as a harbour for boats. A fmall lake is fituated within the land north from the river, whofe outlet is choked with ftones thrown up from the fea. In order to clear the paffage, and convert the lake in-

to a harbour, a canal was dug to the river, and a barricade thrown acrofs its channel, in order to turn the water of the river through the lake. But the barricade being thrown at right angles with the current of the river, the firft flood fwept it away.

As it would be important to have a harbour here, there being no place along this coaft where a veffel can find fhelter, from Loch Ranfa to Lamlafh, and this nearly equidiftant from both; an angular fandftone rock fhould be cut down, and the barricade thrown at an acute angle with the ftream, fo as to conduct it gradually into the canal.

FROM

FROM MACHRY TO GLEN IORSA.*

THE land rifes gradually towards the mountains on the north-eaft of Machry, and exhibits many extenfive tracts which might be reduced to cultivation. The ftrata are moftly red fandftone, interfected by numerous whinftone veins. The ftrata affume a higher angle, and the ground rifes more rapidly, as they approach the mountains, from which they flope, chiefly towards the fouth.

On feveral parts of Machry Moor, and near Auchingallan farm-houfes, many large fragments of pitchftone, of a dark green colour, are vifible, though the folid rock is concealed.

Upon a bank which faces the fea, below the fame farm-houfes, there is a circle of large ftones, faftened in the ground, and including a cairn of loofe ftones. Whether this has been a Druidical temple, or for what purpofe it was conftructed, I fhall not pretend to decide; but it is reputed here to be the grave of heroes.

The firft fecondary mountains we approach in this direction, are irregular blotches of primary

M 3 puddingftone,

* Pronounced *eerfa.*

puddingſtone, which forms bare rounded cliffs upon their ſummits. Of theſe, Vannerloch-hill is the higheſt; and it conſiſts of quartz, granite, ſchiſtic rock, baſalt, and other ſtones of various ſize, apparently cemented in a ſchiſtic ground. Many of the ſtones are angular; and ſome, eſpecially the quartz, are of large ſize.

I proceeded to the top of Bheininhuruch (*Hill of Sheep*). On the ſouth ſide, this hill is compoſed of granitic porphyry, whoſe fellſpars are generally large, and conſiderably rounded. On the north ſide, it is compoſed of micaceous ſchiſtus.

From the top of this hill, the deep chaſm of Iorſa Glen is ſeen nearly to its ſummit. The river Iorſa commences behind Keim-na-caillich; and, receiving many tributary ſtreams, it follows a ſouth-weſt courſe, through the deep chaſm it has ſcooped out, to the ſea. It is bounded by the ſchiſtic mountains on the lower part, which are long, round-backed, and covered with heath. The granite mountains form its boundary on the upper part, which are rounded towards the glen, but abrupt and ragged towards their ſummits. They are almoſt all bare rock, with hardly any intermixture of herbage. In theſe ſilent receſſes, ſterility and deſolation exerciſe an undiſputed ſway. A hollow in the granite mountains conducts to Glen Roſa, as formerly noticed. The bottom of this

this glen is encumbered with bowlder ſtones of granite, or is filled with granitic ſand. The river forms a lake near its centre; and a ſmaller lake, or pool, lower down, among the ſchiſtic mountains, where conſiderable quantities of ſalmon are ſometimes caught.

In tracing Iorſa Glen downwards, after paſſing the ſchiſtic mountains, the firſt viſible rock was puddingſtone, interſected in one place by a vein of whinſtone, in others by veins of red ſandſtone. Next, vertical ſtrata of ſandſtone occurred, alternating with puddingſtone. Beyond theſe, ſandſtone; whoſe ſtrata become more horizontal as they recede from the mountains.

In the mouth of Glen Iorſa, there is a conſiderable valley, and ſome cultivation. On the ſide of the river, this valley exhibits a ſteep bank, compoſed of granitic ſand, intermixed with ſchiſtic clay. In many places, it is ſo far conſolidated, as very much to reſemble ſandſtone. On its top, there is a deep and extenſive moſs; which ſhows that it does not admit water to percolate.

In the mouth of the valley, overlooking the ſea, there is a very large obeliſk, which may be the remains of a Druidical temple.

The cultivated ſoil, towards the ſouth of this valley, has been waſhed down from the ſtrata of red ſandſtone and ſhiver; which, with primary puddingſtone, form its ſouthern boundary. It is

not unfertile, and may perhaps cover the granitic and ſchiſtic depoſite, which occupies the north ſide of the vale; which is extremely unfertile, unleſs we regard the moſs accumulated upon its ſurface, as capable of being fertilized.

FROM

FROM THE RIVER IORSA TO LOCH RANSA.

THIS extenſive tract is chiefly occupied by ſchiſtic mountains, above which the granite forms a long rounded ridge of bare rock, which is broken into rounded detached mountains towards the north. Towards the ſea, the ſchiſtic rock generally preſents an elevated bank, or terrace, on which the cultivated land is ſituated. The ſoil is moſtly a bluiſh micaceous clay, formed from the decompoſition of the ſchiſtus; and, where of ſufficient depth, is not unfertile. Often the ſolid rock juts up through the ſoil; and conſiderable tracts are encumbered by large ſtones. Many tracts, of conſiderable depth of ſoil, are wet; and much waſte land, among theſe mountains, might be improved either for corn, or herbage.

Paſſing the river Iorſa, ſtrata of red ſandſtone, alternating with puddingſtone, are continued along the ſea-bank; and in them are formed ſeveral romantic caves, though not of great ſize. As we approach the ſchiſtic rocks, the ſandſtone ſtrata aſſume a higher angle of elevation. They at laſt become perpendicular, their hardneſs being much increaſed; and their character is changed

changed from common ſandſtone to rubble ſtone, the *Scyrus* of Dr Walker. Advancing further, their red colour is gradually changed into a grey; and that again paſſes into a bluiſh colour, with numerous micaceous particles. The ſtrata now become very irregular; and a conſiderable tract intervenes, where it is difficult to ſay whether the rocks be ſandſtone or ſchiſtus. In fact, the ſandſtone appears evidently to graduate into the ſchiſtus.

At laſt, the rocks become decidedly ſchiſtic; and they have no more ſandſtone ſtrata interpoſed betwixt them and the ſea.

The ſchiſtic ſtrata are vertical; often bent and irregular. During the decompoſition of this ſtone, it has a tendency to ſubdivide into thin laminæ, or plates; which has occaſioned this name to be applied to it. The ſurfaces of the plates are of a grey, or bluiſh grey, or leaden colour; and exhibit numerous ſcales of mica, hence called *Lepidotes*, or ſcaleſtone, by Dr Walker, and *micaceous ſchistus* by others. Theſe plates are never regular, like thoſe of ſlate; but are curved, angular, or ramified, in various whimſical directions. Numerous veins, and rounded maſſes of quartz, are immerſed in theſe ſtrata, which are frequently of a red, but not ſeldom of a ſparkling white colour, and ſubdiaphanous. Sometimes the main body of the ſtratum is quartz, having only a thin covering of the

the ſchiſtus on its oppoſite ſides. When rounded blocks of quartz are immerſed in the ſtrata, the laminæ are commonly ſeen bent and contorted around them in a curious and whimſical manner.

The ſchiſtic mountains here, like the ſandſtone ſtrata in other places, are interſected by numerous whinſtone veins. Theſe veins are commonly of a darker blue colour; nor do they exhibit the arenaceous appearance of many we have deſcribed interſecting the ſandſtone. On the ſea-bank, and ſome of the upper parts, the veins are often ſcooped out, and form deep and irregular channels for burns. Below the village of Immachar, a vein has been ſcooped out by the ſea, leaving a ſmall creek in the ſchiſtic rocks, which is uſed as a very incommodious harbour for the ferry-boat to Sadel in Kintyre. This is the neareſt point of Arran to the mainland of Scotland, the channel being only reckoned from four to five miles acroſs.

The cheeks of the whinſtone veins are commonly harder, and of a darker blue colour, than the other parts of the ſchiſtic rock. Indeed, except in ſome ſymptoms of a lamellar ſtructure, it is difficult to diſtinguiſh the cheeks from the whinſtone. But I did not obſerve any inſtance of a ſeparate and detached vein, on each ſide of the whinſtone vein, as commonly happens where theſe veins interſect ſandſtone.

This

This is the genus of rock in which flate and *ardefia* are commonly found. I faw many veins of flate in thefe rocks, which generally appeared too thin to expect much good from them. But in croffing the farm of Whitefarlan, the property of Captain Fullarton Efq. no fea-bank appeared; and extenfive fields were projected into the fea, of which the foil confifted entirely of broken fragments of dark blue flate. What furprifed me moft of all was, that thefe fields feemed endowed with uncommon fertility, and carried crops of corn and potatoes, equal, if not fuperior, to any I had feen in Arran.

Here the natural woods exhibited a moft picturefque appearance, being fkilfully managed and preferved, which is not the cafe in other parts of Arran. From obvious appearances, I doubt not but a great part of this farm refts on an immenfe vein of flate. In all cafes where flate occurs, there is much more bad flate than good. But among the bad, there is always a main vein, which is good; and I doubt not but fuch a vein may be found here. If found, it may be wrought up from tide-mark, fo as to form a harbour, fafe for veffels which enter with a view to tranfport the flate.

Behind Tundergay there are two confiderable hills of white quartz, or filicious fpar. This is the

the *petunse* of the Chinese; and being mixed with white clay, forms their porcelain ware.

At a place where there is an opening through the long ridge of mountains, ascended Beinbharing. The lower part of the mountain is composed of micaceous schistus, generally covered by moorish soil, and formed into a sort of terraces, which rise above each other in succession. On reaching the granite, the ascent becomes suddenly more steep. Hardly any soil appears; and the eye is sated with the dreary prospect of bare rock. Between the two high granitic mountains, Beinbharin and Muilnadaimh, there is an immense corry, or hollow, in the bottom of which is a beautiful oval lake, of great depth, called Corry-in-lochan. The people here believe that a water-bull, of great ferocity, resides in this lake, and that he often comes out, and uses freedom with their cows.

Saw that Beinbharin has two vast veins, or bones, of granite, consisting of huge blocks, arranged like a regular wall, and meeting at right angles. One of these is projected towards the north, the other towards the west; and the strata respect them, as tiles do the roof of a house. On the east and west sides, the mountain is rounded, and resembles a long barn with a rounded roof. But on the north, the space between these two rectangular veins is scooped out, leaving perpendicular

dicular precipices overhanging the Corry *, awful and tremendous.

On the ſhoulder which connects Beinbharin with Muilnadamh, a vein of granitic porphyry is ſeen running through the granite. It conſiſts of rounded fellſpars and ſmoky quartz, inſerted in an arenaceous ground, of a bluiſh grey colour. Here, alſo, ſeveral fragments of whinſtone are ſeen; but no vein of it could be found.

Advanced along a ſort of terrace on the eaſt ſide of Beinbharin. The lower part of the mountain here is granite, of ſmall grain, reſembling ſilicious ſandſtone, and moſtly of a ſilvery grey colour in its freſh fracture. Above this the large-grained granite riſes bold and abrupt; and it often exhibits a ferruginous tinge.

In one place, the ſmall-grained granite is rapidly decompoſing, and it is furrowed into broad excavations by water. In one of theſe excavations, found a vein of dark blue whinſtone, containing a mixture of pitchſtone, running parallel to a vein of granitic porphyry, arranged in priſmatic maſſes. This porphyry is of a bluiſh grey colour. It contains a few cryſtals of fellſpar, and theſe always rounded; but rounded ſmoky quartz are frequent.

Advanced

* *Corry*, in Gaëlic, means a hollow in the boſom of mountains.

Advanced to Loch Tanadh (*shallow lake*), which may be about a mile and a half long, and averaging a quarter of a mile broad. The plain in which it is ſituated is encumbered by rounded blocks of granite, and exhibits ſtunted heath growing upon a ſoil moſtly compoſed of granitic ſand. The granite mountains in all directions around this plain, are rounded, and exhibit the chilling and ſteril proſpect of naked rocks, only relieved by a few tufts of heath, which increaſe their gloom. This lake diſcharges its waters by the Shirel burn into the river Iorſa.

Paſſed down Glen-Catacol, which deſcends north-eaſtward from this lake. For a conſiderable way the granite is ſmall-grained, on each ſide of the glen, ſuch as was formerly deſcribed. It conſiſts of ſmall angular maſſes; ſometimes of priſms of three or four ſides, of conſiderable length. Theſe fragments are ſhattery and confuſed, and they diſcover no regularity, or approach towards ſtratification. Lower down, large-grained granite occurs; and it is ſeen arranged in tabular ſtrata of various thickneſs, in the bottom of the burn, generally with great regularity. Its inclination is nearly the ſame with the deſcent of the waters. In ſeveral places, it is interſected by large horizontal blocks, to which I have given the name of *granitic veins*. Some whinſtone veins were ſeen to interſect the ſmall-grained granite; and fragments of

of whinſtone and porphyry were ſcattered along the baſe, which muſt have come from veins towards the ſummit of the mountain.

This rugged glen expands into a beautiful valley, called Catacol, about three miles in length, and one mile at its broadeſt part. About a mile and a half from the ſea, the granitic mountains are intercepted by the ſchiſtic, on each ſide of the valley. Their junction is viſible on the ſouth ſide of the valley, and it ſeems to be a perpendicular crack; though exceſſive rain, and approaching darkneſs, prevented its examination.

The ſoil of this valley is chiefly alluvial, from the ſchiſtic rocks; and conſiſts of a bluiſh grey clay, of conſiderable fertility. Where it has been waſhed from the granite, the ſoil is very unfertile, and chiefly conſiſts of granitic ſand, encumbered with rounded blocks of the ſame.

Upon the ſea-beach, at the bottom of this valley, a ſmall green tumulus is ſhown, called Arin, which ſome people think occaſioned the name of the iſland. The traditions of the people concerning this Arin are, that he was a Norwegian freebooter, whom Fioun fought and ſlew here, and that he was buried below this tumulus. This may be all true; but it does not appear probable that his name would be affixed to the iſland which he had unſucceſsfully invaded. Others ſay, that Arin

means

means *Hill of Slaughter*, being the ſpot where Fioun killed a man in ſingle combat.

The rocks, onward to Loch Ranſa, are all ſchiſtic ; in ſome caſes, ſtratified with conſiderable regularity.

GLEN RANSA.

LOCH RANSA extends about a mile within land, beyond which the glen extends ſouth-weſtward about two miles, to the baſe of Tornidneon; its breadth varying from about half a mile to nearly a mile.

In the loch, veſſels find ſafe anchorage when the wind is off the land. Near its head, a green peninſula interſects the loch on its northern ſide, forming within it a commodious baſon, of great depth of water. The ſhifting of the river Ranſa has thrown a bar in the mouth of this harbour; and it would be deſireable to have the river thrown back into its ancient channel, in order to blow out this bar.

On the point of the peninſula are the ruins of Loch Ranſa caſtle, of ſome magnificence. It is ſaid to have been built by one of our Scottiſh Kings, and occupied by them when they came to hunt in Arran. Fordun mentions it as a royal caſtle in 1380. It was latterly the occaſional reſidence of the Skermorly family, anceſtors of Lord Eglintoun, while they poſſeſſed the northern parts of Arran.

The

The foil of Glen Ranfa is moftly fand and chingle, not fertile. It is furrounded by high mountains; the fides, and lower parts of which, are fkirted by natural woods, and even cultivated to a certain extent; the primary foil upon them being better than the alluvial foil of the glen. The mountain called Tornidneon rifes bold and majeftic from the head of the glen; and the naked cliffs of Ceim-na-cailich frown in the back ground.

At the northern entrance of Loch Ranfa, a large vein of dark blue flate is feen to interfect the fchiftic rocks, nearly from north to fouth, and to run into the loch. This would be very convenient for exportation; but I was told it contains fo many cracks, called by the workmen *cutters*, that it could not be worked with profit.

Mr Jamiefon, p. 105, fays, ' Primitive lime-' ftone occurs upon one fide of the loch, but I ' had not an opportunity of examining its fitua-' tion.'

I wifh he had ftated the place where it occurred; for, after the moft diligent fearch, I only found a few fragments of it on the beach, at that part of the harbour where boats ufually land, and where they are drawn up. They had been evidently brought as ballaft. Contiguous to this place, and near the fmithy, a very large, but irregular vein of white quartz, is feen to interfect the

 fchiftic

fchiftic rocks. In fome parts, it difcovers a flight tinge of iron.

At the head of the glen, the Ranfa has cut a deep and narrow paffage through the fchiftic rocks on the northern bafis of Tornidneon (*Heap of Birds Nefts*); and is joined by a ftream, which, burfting through a narrow paffage, forms a glen on his eaftern fide.

Advancing along the very fteep bank projected from the fide of Tornidneon, far below which the Ranfa was foaming in his narrow chafm, we enter an elevated glen called Ifnabirach (*Glen of Queys*). On the fide of Tornidneon, near the mouth of this glen, the granite is feen to meet the fchiftus. The line which feparates them is nearly perpendicular. But an angular projection of the fchiftus is feen to cover the granite for a fhort way, at the fummit; and a fmaller angle of fchiftus is projected into the granite lower down. Detached fragments of the granite are alfo found in the fchiftus, while angular fragments of the latter are found in the granite.

The fchiftus, near the line of junction, is of a dark blue colour, much refembling fome fpecies of bafalt in fracture and hardnefs; and is curioufly twifted and veined.

The afcent of Ceim-na-cailich is eafy in this direction, the back of the mountain being rounded and bare. But on reaching the fummit of the north-eaft fhoulder, our progrefs was fuddenly ar-

refted

rested by a perpendicular precipice of more than a thousand feet in depth. The awful corry, or cavern below, contrasted with the ragged mountains that encircled it, freezed the soul with horror, and, for a time, suspended its active powers.

Two massy pinnacles are remarkable on the highest summit of the mountain. The popular tradition here, is, that a witch bestrode the space between these pinnacles, and let loose such a deluge as washed out the vast hollow below. Hence the mountain derived its name;* and it would seem her ladyship was a Neptunist.

Most of these turreted pinnacles consist of vast quadrangular masses of granite, placed upon each other like regular buildings, and forming strata with a slight inclination to the horizon. One is composed of vast boards, placed almost on edge. Another consists of vast quadrangular columns, not unlike those of basalt. These pinnacles are a sort of veins intersecting the mountain, which the intermediate strata respect, as tiles do the roof of a house.

The granite is mostly large-grained, contains a portion of iron, and is very similar to that of Goatfell. It decomposes more rapidly in the interstices than in the veins. Hence the veins are left

* Ceim-na-cailich, *the Carlin's Step*. It is pronounced Keim-na-cailich, C in Gaelic having always the sound of K in English.

left ſtanding high above the ſurface; and occaſion the wild, ragged appearance which this mountain exhibits when viewed from the eaſt.

The ſides of the mountain and ſummit are interſected by numerous and often broad veins of porphyry, as is viſible from the zones of fragments ſcattered on the ſurface. Some of theſe veins alſo contain pitchſtone, and pitchſtone porphyry, likewiſe viſible from numerous fragments, though I ſaw none *in ſitu*. Below the brow at the ſummit, ſaw two veins of blue whinſtone *in ſitu*.

The higheſt pinnacle of this mountain looks towards Goatfell, whoſe ſerrated profile, with the high, pyramidal, and ſharp pointed mountains which encloſe the Garbh-Chorie (*Rough Hollow*), contraſted with the horrid chaſm itſelf immediately below our feet, exhibited ſuch a picture of wildneſs and deſolation, and danger, as excited at once amazement and terror. This chaſm is even more awfully grand than that aſcribed to the witch's water-works; and the ſhadow of Goatfell thrown acroſs it, added much to its gloom.

This mountain is reckoned of the ſame height as Goatfell. From it we looked over Kintyre upon the weſtern ocean, with Jura, Iſla, and many other iſles ſcattered through it;—over Cowal, and the remote mountains of Argyle and Inverneſs-ſhires;—over Bute, the Cumbraes, and Benlomond in the back ground;—over the ſhires of

Renfrew

Renfrew and Ayr, and the mountains of Galloway; the rock of Isla, towards the south, like a vast balloon hovering over the sea. The coast of Ireland was stretched along, and closed the scene between the point of Kintyre and Loch Ryan.

The highest pinnacle which overlooks Garbh-Chorie, and which forms an immense and rude quadrangular tower, from which it requires a very strong head to look down, is composed of very broad tabular beds of granite, of various, but generally of great thickness, approaching to the form of squares, and placed upon each other in a horizontal position.

Perhaps I may have been wrong in supposing that the stratification of granite respected only veins intersecting the mountains of that rock. This, and the other pinnacles which jut above the summit of this mountain (no parallel to which I had ever seen before), lead me to think, that beside the veins which intersect the granite mountains, there are also pillars which support the looser strata, and resist the effects of their decomposition, or tumbling down. These pillars, like noble and heroic characters in society, still bid defiance to the storm, and continue to support the original grandeur and elevation of their mountain, after the ignoble race, which clung around their sides, have deserted and left them. Yet I do not think that the

the pillars differ materially from the veins I have fo often defcribed. They may be confidered as veins which foon terminate, or whofe continuation has been undermined, and fallen down.

Here follow the bearings of all the granite mountains, of note, in Arran, as feen from the maffy tower that overlooks the Garbh-Chorie; but it muft be remarked, that the remoteft of them are only about one half granitical, the other fide being compofed of fchiftus. It muft alfo be remarked, that Goatfell covered the granitic mountains fouth by eaft of Glen Rofa. We have alfo added their names in Englifh, as far as could be collected.

Goatfell (Hill of Goats) fouth by eaft.
Caftle Abhal (Ptarmigans Caftle) fouth.
Binnuifh, fouth by weft.
Sail Hamdel (Twifted Heel) fouth by weft.
Binlarfin, fouth-weft.
Binbharin, weft.
Binbhree (Flecked Mountain) weft by north.
Muil-na-daimh (Humbled Stot) north by weft.
Tornidneon (Heap of Birds Nefts) north by eaft.

Copious fprings burft from the hollows on the eaft fide of the mountain, and form the fources of the North Sannox water. In a hollow on the northern fide, there is a fmall lake, fed by a powerful fpring which boils up in its centre. This lake

difcharges

discharges itself indifferently, either towards the south-west by the Iorsa, or towards the north-east by the Ransa; and thus it forms the source of two rivers which run in opposite directions. Several very copious springs also burst from the northern side of the mountain, and contribute their waters to the Ransa. As these springs are perennial, there must be large hollows in the body of the mountain where the water is collected, and small apertures by which it is discharged. Perhaps great collections of water of this sort, rising higher than the lateral barriers could withstand, had swept them away, and produced those frightful corrys, or excavations, which abound in these mountains. This opinion derives additional probability from the circumstance, that the corrys are most frequent on the eastern side of the mountains, where there is only a very thin and low barrier of schistic rock, to envelop and support the granite. In all other places, the granite is propped by a broad barrier of schistic rock, in most places rising high upon its sides; and there we find no corrys, except the one described above Tundergay, in the side of Beinbharin, where the mountain towers high above the schistic rock. The gradual action of streams of water seems to have scooped out those deep chasms and glens which intersect these mountains. These are sometimes rounded on both sides; but if they be precipitous on

on one ſide, they are rounded on the oppoſite.

On the northern ſide of Ceim-na-Caillich, numerous veins and blotches of white quartz, of various dimenſions, occur. In theſe we ſee the cryſtallization of the quartz exhibited, in every degree, from the rudeſt approach towards a regular form, to the perfect topaz. Sometimes a pyramidal apex is formed, terminating in ſplintery quartz. Sometimes an elongated cryſtal is preſented, whoſe baſe is ſplintery quartz. At other times an elongated cryſtal, terminating in a pyramid at both ends, of which the external end is always thickeſt. The laſt are perfect topazes, and they are of very various ſize. They generally form a column of five ſides, of which one end is thicker than the other, and terminate in pentagonal pyramids at each end. Many of them are white and tranſparent; ſome are ſmoky; and ſome are yellow, reſembling the topazes of Cairngorum.

It was formerly obſerved, that the granite of Arran did not contain the uſual proportion of talk inveſting its cryſtals. To compenſate for this, there are ſeveral veins of talk on the weſt ſide of this mountain, interſecting the granite. It is of a dull grey colour; breaks acroſs into rhombuſes of about an inch; ſubdivides into thin laminæ, which are flexible and tranſparent; and their tranſparency is much increaſed by heating to redneſs.

The

The rivulet which has formed the glen on the eastern base of Tornidneon, descends from the side of Ceim-na-Cailich; and, taking a northern direction at right angles to its former course, joins the Ransa as formerly described, forming Glen-Halmidel (*Glen of Pigeons*). Another burn descends near, and parallel to it; but, suddenly taking a southern course, falls into North Sannox water. These two burns form a very extensive tract into a sort of peninsula, called Benleven (*Flat-topped Mountain*), having the bay and glen of Sannox on the south, and the loch and glen of Ransa on the north. In the mouth of the Halmidel there is some cultivation; soil, decayed schistus. Through it a very precipitous tract, formed in some places into a road, passes to Sannox. Were nature studied, a very easy road might be made in this direction.

On entering this glen from the Ransa, we find it composed, for a great way, of slate, mostly of a greyish blue colour. Ascending the summit of the mountain, we find several slate quarries, from which slate had formerly been wrought to a considerable extent. The main quarry, which yielded the best slate, was wrought as far down as water would permit. The slate is arranged in strata, at an angle of 45°, and, of course, rapidly sinks under moisture, as its rise is contrary to the declivity of the mountain. No slate is good which is naturally dry,

dry, and expofed to the viciffitudes of the weather. Mr Cowie, who managed this quarry, in order to get better flate, and in greater quantity, led up a covered drain, which would have commanded the flate more than twenty-five feet below the former workings. But when the object was nearly accomplifhed, he was obliged to defift from want of funds.

This flate is of a greyifh blue colour, with fometimes a flight tinge of purple. Towards the dip, it is of a darker blue, which is the beft. It is the *fteganium* of Dr Walker *, not *ardesia* †, as ftated by Mr Jamiefon, p. 113.

From thefe quarries a road has been made down the fide of the mountain, to convey the flate to Loch Ranfa harbour, diftant about two miles.

The other rocks on this fide of Benleven, are micaceous fchiftus, in which numerous rounded maffes of quartz, often of large fize, frequently occur. Around thefe nodules, the laminæ of the fchiftus are frequently feen contorted in a curious manner. In the bottom of the burn, feveral whinftone veins are feen to interfect the fchiftus.

The fummit of this mountain is moftly a level plain, of great extent, and covered with peatmofs.

Numerous

* See Note [O.]
† See Note [P.]

Numerous fragments of hæmatites are found imbedded in soft clay, within tide, on the south side of Loch Ranfa. These must have been part of strata which formerly covered the schistus here, but which have mouldered away. It is probable the same strata still continue to occupy the bottom of deep water, though here they have been worn down by the waves, and exposure to the weather.

FROM

FROM LOCH-RANSA TO GLEN-SANNOX.

THIS is the ſea-beach of Benleven, of which we have attempted to deſcribe the ſide towards the land.

Advancing along this ſhore, the firſt remarkable thing that occurs is at Craig-na-Srone (*Nose Rock*), where the ſecondary ſtrata are ſeen reſting upon the micaceous ſchiſtus. The firſt ſtratum of this kind is a ſort of chalky limeſtone, which contains rounded pieces of quartz, fragments of ſchiſtus, &c. ſo as to conſtitute a ſpecies of puddingſtone. Many parts of the ſtratum contain few of theſe extraneous bodies, and would make excellent lime. Further on, a ſort of puddingſtone, red ſandſtone, and ſhiver, occupy the coaſt.

Where the limeſtone reſts upon the ſchiſtus, three whinſtone veins interſect the ſchiſtus, and the ſtrata that reſt upon it. Where theſe veins run in the ſchiſtus, the cheeks on each ſide are penetrated by the whinſtone; and fragments of the ſchiſtus are found immerſed in the whinſtone veins. One vein divides into two, like the letter Y; and pieces of ſlate are found immerſed in the whinſtone, at the angle of ſeparation.

The Scriden rocks are ſtrata of breccia, or puddingſtone,

dingſtone, of moſt enormous thickneſs, and leaning upon the ſide of the mountain at an angle of about 45°. About a hundred years ago, immenſe maſſes fell from theſe rocks, and now encumber the beach, rendering it difficult and dangerous to paſs along ſhore. The concuſſion ſhook the earth, and the ſound was heard in Bute and Argyleſhire. On climbing towards the ſummit, found the whole of this enormous maſs of ſtrata, which reaches almoſt to the top of the mountain, had ſhifted from its original poſition; and that its tranſverſe ſections were ſeparated from each other, ſo as frequently to leave ſpacious gaps between. In many caſes too, the upper maſſes ride upon the ends of thoſe below them; which, having no viſible ſupport, excite the moſt lively apprehenſion that the whole is about to fall, and cruſh the beholder to atoms. The Scriden rocks are reckoned the extreme point of Arran, towards north-eaſt.

Red ſandſtone, with ſometimes puddingſtone, continue along the coaſt, and aſcend to the top of the mountain where they meet the ſchiſtus.

Near the Cock, theſe ſtrata are interſected by a great vein of porphyry, the ſouth-eaſt ſide of which conſiſts of rhomboidal, ſharp-angled cryſtals of fellſpar, inſerted in a red ground. On the oppoſite ſide, the ground is moſtly blue baſalt, with ſome ſtreaks and ſpots of red intervening. This vein ſeems to riſe to the top of the mountain; and it

it exhibits a curious ſpecimen of different ſpecies of porphyry combined in the ſame maſs. I do not ſee how the igneous theory can account for it; becauſe, had it been raiſed from the bowels of the earth in fuſion, it ought to have been homogeneous in its ſtructure. The variety and ſeparation of materials, ſhews they had been conveyed into a chaſm in the ſtrata, at different times, and from different ſources; where they conſolidated, by the attraction of coheſion, which operates upon bodies whoſe particles are brought into cloſe union, by extreme pulverization. The earths, too, when minutely pulverized, combine with water, and paſs from it, either in the form of cement to unite the groſſer particles, or in the form of cryſtals. One point is clear, that the felſpars in this porphyry had not, like thoſe we have ſo often deſcribed, been conveyed to their preſent ſituation in a ſolid ſtate, becauſe their angles are not blunted, or worn. They muſt therefore have conſolidated where they are now found.

The Cock is not a ſolid rock, as I expected, but a huge maſs of ſandſtone that has fallen from the rocks, and ſtands on a narrow baſe upon the beach. It has acquired this name from mariners, to whom it ſerves as a land-mark, and to whom it preſents a very lively repreſentation of a cock crowing, and clapping his wings.

Contiguous

Contiguous to the Cock, are irregular veins of basalt intersecting red sandstone, of a dark blue colour internally; but the sides next the sandstone are of a deep red colour, smooth and glossy like Roman bricks. The breadth of these veins varies from about one to three or four inches. Further on, the same sort of veins occur in red indurated clay shiver.

Several massy strata of indurated clay occur, of a florid red colour, to which the sea has conveyed a fine polish. From these, I am confident, vases, urns, jars, and all the more durable species of earthen ware, might be fabricated, susceptible of a jaspidean polish; and, being variegated with spots of different colours, might emulate the most elegant porphyry.

Within tide, are several strata that look like a Mosaic pavement of finely polished brick, of a florid red colour. They consist of equilateral pieces, or rhombi, of indurated clay, divided by septaria which run in straight lines parallel to each other, and are crossed by other straight and parallel lines with the greatest regularity, so that each rhombus is enclosed within septaria, which separate its sides from those of other rhombi, which are parallel to them. The breadth of the rhombi may be about fourteen inches; that of the septaria about half an inch. The colour of the septaria is a pale red, inclining to whiteness; and it looks very like puzzolana

zolana cement, in the interſtices between regularly formed ſtones. In many caſes the pavement is worn down; but the cement, which is harder, preſerves a regular equality of height.

I doubt much if the moſt ſkilful maſon, or even a mathematician, could produce any thing more regular, or more beautiful.

Here are numerous ſtrata of red clay ſhiver, and of red ſlaty ſchiſtus, which include various ſtratulæ of hæmatites, and of kidney ironſtone. The hæmatites is generally arranged in ſtratulæ, but often interſperſed. When ſtratified, it generally comes off in rounded pieces, whoſe ſides are perpendicular, and are thicker towards the centre, than towards the circumference. When interſperſed, the pieces are generally broader, are of a round, or oval form, and flattened towards the circumference.

The pieces that have been long expoſed to the air, are of a blood-red colour, though darker towards the centre. But by a little digging, pieces are found, with a red tegmen, but internally of a fibrous texture, the fibres at right angles to the breadth of the ſtone, and the colour that of ſteel. The interſperſed pieces often exhibit an indented fracture, where the ſurface of the indentations has the luſtre of ſteel.

The kidney-form pieces often exhibit a dull red earthy appearance to their centre. But, where they

they have not been too much expofed to the atmofphere, they difcover a radiated texture, with the luftre of fteel.

Thefe two fpecies feel very heavy; but there are alfo other ftratulæ, which, though good ironftone, feem to contain a proportion of clay, and do not feel fo heavy.

The people here call this ironftone *keel*, and ufe it for marking their fheep, and various other purpofes. It has a greafy feel, and gives a ftain to the hands, which it is difficult to wafh off.

The farm of Cock is on a fteep bank projected from the fide of the mountain. The foil is moftly of a blood-red colour, and is compofed of the debris of the fchiftus, and of the ironftone which it includes. It is wholly encumbered with this ironftone. Where burns had made excavations, I traced thefe ironftone ftrata to the fummit of the mountain.

What is moft extraordinary, great quantities of this ironftone are found, imbedded in clay, below peat bogs, on the flat fummit of the mountain. This clearly fhows that the fummit was formerly covered by ftrata of red fchiftus, including ironftone, which have mouldered down. Much of the clay may have been wafhed away, leaving the ironftone, which water could not eafily carry from a flat furface.

 But

But as we may afterwards have an opportunity of reconſidering this ſubject, we ſhall not enlarge further at preſent.

Connected with the latter, are ſeveral ſtrata of limeſtone, of a florid brick, or blood-red colour. Such limeſtone always occurs, where hæmatitical ſtrata preſent themſelves along the coaſt. We ſhall therefore take no further notice of this limeſtone, until we reach Currie, beyond which it was not obſerved.

A ſtratum about three feet in thickneſs, and formed into blocks of from three to four feet in length, attracts attention. This ſtone contains innumerable ſhells, chiefly madrepores, ſome of which exhibit a bright crimſon colour. The ground of the ſtone, is ſomewhat calcareous, and in its fracture every way reſembles jaſper, of a chocolate colour. It may, not improperly, be called jaſpidean marble. Were it poliſhed, it would exhibit a ſtriking appearance.

Advancing onward, the ſtrata upon the beach are ſuddenly changed. White and grey ſandſtone, with ſometimes a mixture of yellow, occur, and are continued a great way.

In theſe the Cock coal is included. It is confined within an angular ſpace, formed by two ledges, or edge-ſeams of limeſtone, one from north-eaſt, the other from ſouth-eaſt, which meet at right angles. To the north and ſouth of theſe ledges

ledges of limeſtone, though the white ſandſtone extends a long way, and includes numerous beds of black bituminated ſhiver and blaes, no ſtratum of coal has been found.

There are three or four ſeams of coal running parallel from north to ſouth; the principal, or main ſeam, being about fourteen feet in thickneſs. They dip nearly towards north-eaſt, at an angle of 45°. Pits were ſunk, and efforts uſed to work this coal, about fifty years ago; but as there is no harbour to export by ſea, and a road muſt be cut ſeveral miles through rocks, a ſalt-pan was built, to conſume the coal in the manufacture of ſalt. The undertaking ſeems not to have ſucceeded, and was ſoon abandoned.

This coal is of the ſame ſpecies with that at Kilkenny in Ireland; and there are ſimilar ſtrata in Ayrſhire, in Fifeſhire, and various parts of Scotland. It is blind coal, of uncommon excellence. It is not ſo apt to fall into powder as moſt other ſpecies, and, when freſh dug, it exhibits a metallic luſtre. It is hence called *glance* coal by ſome; but this word does not diſtinguiſh it from ſome of its own varieties, which have no luſtre; nor from ſome ſpecies of bituminated coal, which have a ſhining appearance. The word *blind* coal is more expreſſive of its peculiar property, in emitting neither flame nor ſmoke; as it conſiſts

fists of carbon, without any impregnation of bitumen.

I could not learn that the working of this coal was abandoned, becaufe it 'foon difappeared,' as ftated by Mr Jamiefon, p. 101.; but that, from its inacceffible fituation, they could not work it with profit. Boiling falt could hardly abforb their refufe, far lefs fuch a quantity as would keep the pit conftantly going. It is well known, that if there be not a demand fufficient to abforb all that is turned out, no coal can be worked with profit; and that the working cannot be abandoned and refumed, according to the fluctuations of the demand; becaufe, in that cafe, men's wages would be running on, the machinery would be rotting, while the pit would be drowned with water.

Mr Jamiefon alfo ftates 'the great frequency 'of bafaltic veins as another caufe, which muft 'render the coal, if it fhould ever be detected, of 'an indifferent quality, and difficult to work.'

With regard to the bafaltic veins, I remarked it as an uncommon circumftance in Arran, that I could not find a fingle bafaltic vein in the coal-field, or as far as the white fandftone extended on each fide of it. There did not therefore appear to be the fmalleft ground for believing that the coal was cut off, or its quality injured, by bafaltic veins.

When

When they wrought the main ſeam, by digging along its outcrop a large open trench, they came to the ſtrata which form the ſteep ſide of the mountain, and which here riſe at an angle of nearly 70°. They thought the coal extended through the baſe of the mountain, and cut a mine to follow it out. Had they beſtowed the ſlighteſt attention, they might have ſeen, that the ſtrata on the ſide of the mountain are very different from thoſe which include the coal; and that, when the latter touch the former, they ſuddenly terminate. The ſtrata on the ſide of the mountain appear to have been of much earlier formation, and they riſe at a much higher angle, than thoſe which include the coal. Nor does it appear that the quality of the coal was in the leaſt affected by its approach to the mountain; for it was equally good until it was cut off.

On examining the ſtrata perforated by their mine, I found them to be ſilicious ſandſtone flags, of great hardneſs, and of a browniſh white colour, their ſurfaces exhibiting micaceous ſcales. They are from one to two inches in thickneſs, and are curiouſly bent upwards, into the form of a Gothic arch, or rather of a great many arches overlapping each other, which form the roof of their mine. It was uſeleſs to follow the coal from the ſtrata where it was found, into ſtrata ſo very different, both in quality and poſition. As far as I could

 learn,

learn, the coal only failed them here, where they had no right to expect it.

From the position of this coal, there can be no doubt but it expands to a great extent below the sea. If ever it be found convenient to work it, I conceive it should not be by sinking pits, but by sinking in the stratum itself, and drawing it up the inclined plane of sandstone, on which it rests, by carriages running upon rollers.

This coal, being esteemed pure carbon, and capable of producing a most intense heat, I am surprised it never has been applied to the smelting of iron, and other fornacic uses. The ironstone here seems inexhaustible, and of excellent quality. A harbour might be scooped out of one of the ledges of limestone, which enclose the coal-field; which would cost nothing, as the limestone would repay the expense with profit. From this, the coal and ironstone might be exported to a situation favourable for an iron-work.

Some strata of bituminated shiver, or shale, of a black colour, are visible, not only in the coal-field; but many are visible, for a great extent, on each side of it. These strata sometimes throw out an efflorescence of sulphate of magnesia.

But in one of the seams of coal which Mr Cowie had wrought in the way called *open strench*, for the purpose of burning limestone, I observed a highly bituminated species of till, of a black colour. This appeared,

appeared fo extraordinary, that I requefted Mr Cowie to write down a defcription of it, which follows.

'The feam of coal, at the Cock of Arran, 'wrought by James Cowie, is firft about ten 'inches, then eight or ten inches of a dauchy 'till, then twenty inches of coal. The dauch 'which feparates the two feams of coal, is ar-'ranged in this manner like the 'back-bone of a fifh, and rifes in large pieces, 'but parts in the middle. The till between the 'two feams of coal ferves to burn lime.'

Mr Cowie added, that the dauch was always mixed with the blind coal in burning lime. That it feemed to kindle more readily than the coal; and the only difference was, that the dauch always left a large *gueft* (cinder); whereas the coal burnt into a fine white afh, of very fmall quantity.

Here, then, are highly bituminated ftrata of clay, not only connected with blind coal, but one interpofed between two feams of that foffil.

Our men of fire make their favourite element operate as many contradictions, as the hocus-pocus tricks imputed to phlogifton by the older chemifts. At one time, phlogifton could not penetrate the moft porous bodies; at another, the moft denfe were infufficient to confine it. At one time, it was the caufe of gravity and attraction; at another, of levity and repulfion.

These

Theſe gentlemen aſſert, that blind coal has had its bitumen evaporated, by the great heat which elevated the ſtrata, from want of ſufficient preſſure to confine it; and that bituminated coal retained its bitumen, while ſubjected to this heat, in conſequence of the enormous preſſure which prevented its eſcape.

But I would aſk theſe gentlemen (if they are not too *hot* to give a *cool* anſwer)—How came the clay ſtrata, in the ſame alternation with the coal, to retain their bitumen, while the coal was deprived of it? But eſpecially, how came a ſtratum of clay, included between two ſtrata of coal, to retain its bitumen, while both the ſtrata of coal loſt theirs? I cannot ſee how theſe gentlemen can anſwer theſe queſtions, in a way conſiſtent with their theory.

They refer us to the ſandſtone which covers the blind coal, and allege we ſhall find ſome traces of the bitumen there. But though I examined the ſandſtone ſtrata which formed the immediate roofs of the ſtrata of coal, and many others, with the utmoſt care, I could not find the ſmalleſt viſible trace of bitumen in them: nor could I trace the ſlighteſt mark of vegetable impreſſion, either in the ſandſtone, or in the bituminated ſhiver connected with the blind coal.

Bitumen, particles of coal, and remains of vegetables, I have always found in the ſandſtone

ſtrata

ſtrata that covered bituminated coal; and often, in the coal itſelf, vegetable remains occur. Hence I inferred, that ſuch coal had been formed from vegetables; and the marks I formerly aſſigned of ſandſtone, including coal, applied only to bituminated coal. Blind coal appears to be *ſui generis*, and to have been formed without the aid of vegetables.

But without pretending to aſſign the mode of its formation, I think I am warranted to aſſert, it was not formed in the way our fiery philoſophers allege; and that the facts ſtated are fatal to their theory, as far as it depends upon preſſure, or defect of preſſure.

The ſtrata of white ſandſtone, and of bituminated ſhiver, occupy the coaſt only a ſhort way, on the north of the coal field; but on the ſouth they prevail for ſeveral miles.

Beyond the Cock coal, there is a farm called Laggan, where, what ſoil there is, appears fertile. Below this farm, a vaſt ledge of limeſtone is exposed by partial working on the ſea-beach, and forms a ridge through the land. This is the ledge deſcribed as cutting off the coal in this direction.

It is of a blue colour, ariſing from bitumen; and contains many large oyſter, and other ſhells.

For a long way white ſandſtone continues, and alternates with ſtrata of blaes, of various, but many of very great thickneſs. Many of theſe latter

latter ſtrata include numerous ſtratulæ of carbonated ironſtone, of a blue, or black colour.

Theſe ſtrata dip at various angles, from north to north-eaſt. A few ſtrata dip in the oppoſite direction.

For about a quarter of a mile, the ſtrata are wacken porphyry, regularly dipping like the others. Here whinſtone veins, of a blue colour, again make their appearance, and interſect the ſtrata.

In one caſe, a vein of porphyry, varying between red and purple, containing white ſilky concretions of ſparry lime, interſects theſe ſtrata.

Beyond this, ſtrata of blue baſalt, ſubdivided into columns, of various, but none of great thickneſs, alternating with bituminated clay ſhiver, of a black colour, occupy a conſiderable portion of the beach. Theſe ſtrata obſerve the general dip, but not at ſo high an angle. Next, bluiſh ſandſtone, alternating with red ſhiver. Laſtly, red ſandſtone, alternating with puddingſtone, red ſhiver, and red ſlaty ſchiſtus. The ſhiver and ſchiſtus include many ſtratulæ, and are thickly interſperſed with hæmatites. Many of the ſchiſtic ſtrata, are partly red, partly white, in the ſame fragment. The latter do not ſeem to contain much hæmatites.

Intermixed with the ſtrata from where the white ſandſtone terminates, are ſeveral maſſy ſtrata of indurated clay, often poliſhed by the ſea. They are either of a white, or greyiſh colour, ſometimes varied

varied by spots of faint red, or purple. They seem highly deserving the attention of potters.

The farm of Laggantwine is the third and last upon the side of this mountain. It is situated in an elevated corry, or hollow, scooped from the side of the mountain. Soil mostly of a red colour, being formed from the decomposition of the strata which had formerly leaned towards the schistus here; and much more might be gained than is actually cultivated.

On the north-east side of this corry, the micaceous schistus is projected towards the sea, and forms a mountain of curious construction. The schistus is suddenly cut off by a perpendicular vein of primary puddingstone, consisting of stones of various size, mostly angular, inserted in a schistic ground, of a bluish grey colour. Next to the perpendicular vein of puddingstone, a great many strata of calcareous puddingstone lean towards the mountain. Those next it are almost perpendicular, but they deviate as they recede, and the outermost forms an angle of about 80°, dipping towards north-east. All these strata rise to the summit of the mountain.

The calcareous puddingstone contains rounded pieces of quartz, jasper, flint, red sandstone, and sandstone schistus, dispersed in a ground of indurated chalk. The strata of this description form the

the external covering, facing the ſea, in which the concretions ſometimes ſuperabound, ſometimes the chalk.

Many of the interior, and parts of the exterior ſtrata, are compoſed of rounded pieces of white indurated chalk, inſerted in a grey ground of the ſame material, without any apparent mixture of flinty concretions. Theſe ſtrata are, in fact, calcareous puddingſtone.

This mountain cannot be viewed from the ſea-beach without aſtoniſhment; and as numerous fragments have fallen from the lower parts of the external ſtrata, ſo as to leave them, apparently, only a pivot to reſt upon, our aſtoniſhment at their grandeur is mixed with fear of their ſudden fall.

In the ſame line of bearing, which is nearly from ſouth to north, the ſame ſtrata are found within tide-mark, and jut occaſionally through the ſoil on the ſea-beach. In the firſt caſe, they are moſtly covered by ſand and chingle; in the laſt, by ſoil.

It would be eaſy to cut a commodious harbour through theſe ſtrata, from the ſea, the value of the limeſtone more than defraying the expenſe. After this is done, a few blaſts inſerted in the baſe of the ſtrata, to be fired by a train which might allow the workmen time to eſcape, would bring down the whole ſide of the mountain, and afford

materials

materials from which limeſtone of the beſt quality might be ſelected, ſufficient to ſupply the conſumption of ſeveral generations.

Beyond Laggantwine, the firſt viſible rocks are a mountainous ridge of pudding ſtrata, of enormous thickneſs, which projects towards the ſea. Where this ridge approaches the ſea, immenſe maſſes have fallen down, and encumber the beach; producing a wild and romantic effect; but not unpleaſant, as there is an eaſy paſſage through them. Moſt of the pudding rocks here have a calcareous ground, and ſome would even make lime.

Beyond this promontory, the ſame ſtrata ſeemed to be continued, though not ſo maſſy; and the acclivity of the mountains begins to be much leſs abrupt, until the ſea-bank becomes low, and the land riſes gently from the ſea.

Below the farms of North and South Sannox, there is a bold projection of pudding rock, with an extenſive plain on each ſide of it, and a level parterre between it and the ſea. This rock is covered, and ſurrounded, on either ſide, with natural woods, of great extent; and the ſemicircular parterre in front of it, is the moſt beautiful and romantic ſpot I ever beheld.

Did not obſerve any whinſtone veins penetrating theſe pudding rocks; and whether they penetrated the ſtrata on the ſhore, I had no opportunity

nity of obferving. When benighted in fuch fituations, without guide or attendant, an obftacle is thrown in the way of deliberate obfervation; and the fear of breaking one's neck, induces a neceffity of employing the faint glimmering that remains, in fcrambling towards quarters.

CURRIE.

CURRIE, &c.

FROM the Sannox to Arran Caſtle, the ſea-bank is generally low, and ſometimes ſlopes down to the beach. An extenſive terrace, of from one to two miles in breadth, is projected from the baſe of the mountains towards the ſea. This terrace is cultivated in ſome places; but it exhibits extenſive tracts, of excellent ſoil, on which cultivation has never operated. Some places are wet and ſwampy, but might eaſily be drained. Others are encumbered with ſtones, and ſhould be planted. In many places, the mountain torrents have cut through this terrace deep ravines, which are ſkirted by natural wood. Much natural wood abounds at the Sannox and Currie, which, were it preſerved, might become valuable.

The mountain called Cir Mhōr (*Great Comb, or Creſt*) above Currie, from ſome points of view appears like a vaſt building flanked by two maſſy towers. Between this mountain and Cich-na-h'nighean (*Virgin's Breaſt*), a vaſt corry, or hollow, is ſcooped out, which exhibits a ſcene rocky and wild. A ſtream of water flows from it, which is fed by ſprings burſting from the baſe of the rocks.

rocks. As there is only a very ſmall barrier of ſchiſtic rock, facing this mountain, it is probable the corry may have been produced by water accumulating in a perpendicular hollow, until its preſſure overcame the lateral barrier, as was ſtated reſpecting Ceim-na-Cailich. This corry is rounded on all ſides to its ſummit, the ſides being formed of looſe blocks; which ſhows there are no veins here of large maſſes, which always form the precipitous ſides of granite mountains.

Deſcending by the ſmall ſtream which flows from this corry, the granite begins to be ſtratified with conſiderable regularity. In one place, it is interſected by a large vein of puddingſtone, conſiſting of fragments of quartz and granite, inſerted in a ſchiſtic ground of a bluiſh grey colour. Towards the ſouth, this vein ſwells into little hills. Below this vein, the granite reſumes its former regularity, and is ſoon intercepted by micaceous ſchiſtus, of which the barrier is thin; then primary puddingſtone occurs, of a ſchiſtic ground; and, laſtly, red ſandſtone.

Cich-na-b'nighean has a moſt ſtupendous pyramidal pillar of equal altitude with the mountain from which it has been detached, in many points of view very much reſembling a virgin's breaſt, which has occaſioned the name of the mountain. In this pillar, the granite exhibits a confuſed arrangement, without any regular ſtratification.

To

To the north of this, a very deep glen is ſcooped in the granite mountains, from which the water of South Sannox flows. Its mouth is bounded by Cich-na-h'nighean on the ſouth, and by Suidh (*The Seat*) on the north.

Deſcending into this glen, found it penetrated far into the granite mountains, and, like the corry of Cir Mhōr, was bounded by rounded ridges of granite. The glen, and the channel of the ſtream for a conſiderable way below, are encumbered with rounded blocks of granite; but, on following the ſtream, ſtratified granite occurs—then ſchiſtus—then primary puddingſtone of a ſchiſtic ground—then ſtrata of red pudding and ſandſtone alternate, until they reach the ſea-beach. The latter are frequently interſected by veins of hard blue whinſtone.

At one part of South Sannox water, large and irregular veins of ſpathum ponderoſum, or ponderous ſpar, interſect the pudding and ſandſtone ſtrata. Some of theſe are of great magnitude, and exhibit a lamellated ſtructure, with ſmall red, or black ſtreaks, the latter probably owing to lead. Other parts are a ſort of ſpathic puddingſtone, and include rounded pieces of quartz, and even rounded pieces of ſandſtone.

Theſe veins run due north, and there is no opportunity of tracing them in the diſtrict between South and North Sannox waters, becauſe the ridge

is mostly covered with heath, or with natural wood. Perhaps when the land is torn up, and reduced to cultivation, this ponderous spar may be found jutting to the surface, and may include ore of lead.*

But in the channel of North Sannox water, at the distance of nearly two miles, two small veins of the same spar were seen running in the same direction with those in South Sannox water; and the space betwixt them is occupied by a very broad vein of whinstone.

The strata in North Sannox are similar to those described in South Sannox; and at the mouth of the former river there is a bed of peat-moss within tide-mark.

Above where the road from Glen Ransa crosses North Sannox, the primary puddingstone commences. A striking singularity occurs here, viz. a broad vein of irregular blue slate, intersecting the puddingstone.

The puddingstone forms jutting rocks on the south side of the glen; then schistus occurs; and, lastly, the granite of Ceim-na-Cailich; from whose bosom the main stream issues, as formerly described.

The

* Since this was written, having accidentally looked into Mr Pennant's Tour to the Hebrides, I saw he had observed these veins, and had formed the same opinion of their contents I have here expressed.

The general inclination of most of the strata, from Loch Ransa to the Sannox, is, more or less, towards the north. But here the inclination begins to observe a contrary direction, and is pointed, more or less, towards the south.

Leaving the limestone for future consideration, the general strata along this beach are red sandstone, alternating with puddingstone. Sometimes the sea-bank is a perpendicular rock of puddingstone, which seems to rest upon the last mentioned strata; and frequently these strata are seen to pass under a pudding stratum of great thickness.

The red sandstone includes many strata of red shiver, or slaty schistus; and these, again, contain many stratulæ, or are thickly disseminated with hæmatites, or kidney ore of iron. The ironstone continues to occur, in great quantities, to the distance of more than a mile to the south of Currie; beyond which, no more of it was observed.

There are also several strata, of great thickness, of indurated clay, some of which seem well adapted for making fire-bricks; others for the potteries; though none of the latter seemed to equal, in purity, some that occurred further north.

These strata are frequently intersected by whinstone veins; and, near the burn of Currie, there is a large irregular vein, or rather blotch, of porphyry, similar to other veins further north. It consists of various concretions, the principal of which

which are white silky pieces of spar of lime, inserted in a vivid red ground, variegated with nebulæ, and streaks of purple. It also exhibits large rounded blocks of blue whinstone, or basalt, immersed, and firmly cemented in it. When any of these are knocked out, they leave a hollow distinctly moulded by their shape.

At the Currie, there are immense strata of sandstone, of a fine grain, and pure white colour. These strata form two series. The one to the north is harder, coarser, and not so white, as the series towards the south. The southern series has a harbour cut out of the solid rock, which admits vessels for its exportation. Between two strata of this stone, a bed of bituminated clay shiver, of a dark blue colour, is visible, which might afford some hope of coal under the strata. But the inclination of the strata being towards the south, is rather unfavourable to coal, as far as my very limited experience in these matters extends; and, if coal were here, it must be seen in the outcrop of the strata on the sea-beach.

We shall now enumerate the various limestone strata in this district, beginning with those situated towards the north.

1. In South Sannox farm, a vast rock of limestone rises from the sea-beach, and runs up through the moors, until it approaches the mountains. In some parts this is a puddingstone, containing rounded

ed pebbles, and pieces of ſandſtone, inſerted in a ground of white indurated chalk. In other parts, no extraneous concretions appear. It conſiſts of ſeveral beds of great thickneſs, of which the bottom is not expoſed to view. The ſuperficial bed contains great numbers of pebbles, while in thoſe below, none are viſible. No ſhells appear in this ſtone; and it ſeems well adapted for being wrought by mining, leaving the ſuperficial bed as a roof.

2. In Currie Burn, there is another vaſt body of limeſtone, which riſes from the ſea-beach, and runs a long way up the ſide of the burn, and paſſes over the hill towards the mountains. At the mouth of the burn its outcrop has been ſwept away, and covered with rubbiſh. This is of the ſame quality with,

3. The quarry now working, and which has been wrought to a conſiderable extent. It riſes from the ſea, where the ſtratum has been ſcooped out, ſo as to form a harbour for its exportation to Greenock, Glaſgow, and various other places. It riſes along the hill, parallel to the other ſtrata, and to the white ſandſtone already deſcribed. The ſtratum conſiſts of fifteen beds, alternating with thick beds of rich marly ſhiver, of a red or purple colour; ſo that for light, ſandy, or chingly ſoils, the rubbiſh of this quarry would anſwer much better than lime. The ſtone is of a blue, or purple colour, and contains numerous ſhells, chiefly large

 oyſters

oyſters and clams, which retain their natural ſhape. The marl alſo contains ſome ſhells; but they are generally compreſſed, or broken into fragments. Often it exhibits broken impreſſions of ſhells, where no ſhell actually remains.

4. South of the Sandſtone Harbour, there is a ſeries of limeſtone ſtrata, of a florid blood, or brick-red colour, which alſo riſes over the hills. I formerly deſcribed a ſimilar ſtratum of limeſtone at the Cock; and ſeveral other ſtrata, of the ſame appearance, occur in the extenſive tract between the Cock and Currie. As this ſtone ſeems to contain no other alloy but iron, it would be worth while to try whether, without the addition of puzzolana or terras, it would not make cement for buildings under water.

5. South of this there is another vaſt ſtratum of limeſtone, running over the hills, called the Caſcade Quarry, from a beautiful caſcade that falls over a rock below. This ſtratum is not viſible on the ſea-beach, being probably covered with chingle and ſtones. It is of the ſame quality with the quarry now working, but it never has been wrought.

6. About a mile ſouth from Currie, and about a mile above the ſea-beach, in the ſide of a hill, there is a ſtratum of limeſtone called the South Quarry, which has been wrought to a conſiderable extent. It contains the ſame number of beds with the

the Currie Quarry, only they are thinner. In all other respects they are similar. They rest on red and purple marly shiver, and are covered by white sandstone. A road has been made from this quarry to the sea-beach, where a small harbour is formed of loose stones for its exportation. There is reason to believe that this stratum, though concealed by earth and stones, descends to the sea-beach; and that it may be found entering the sea at a small sandy bay, north of the harbour just mentioned.

All these strata, and those connected with them, incline towards the south at an angle of about 45°; and their line of bearing, or outcrop, rises from east to west, with the acclivity of the land, towards the granite mountains.

Natural magnets have been found on the sea-beach below the South Quarry, probably detached from a stratum of ironstone by the sea. Though I searched, I found none.

SEA-BEACH TO ARRAN CASTLE.

ONE circumſtance ſtrikes us upon this beach, *viz.* the enormous maſſes of granite which are ſcattered on ſeveral parts of it. Some of theſe are like detached rocks, and are not much rounded, not having had a long journey from the neighbouring mountains: though many of the ſmaller blocks are conſiderably rounded, theſe having been carried down by ſtreams, while the firſt rolled down by their immenſe weight, when the mountains were much higher, and the projecting declivity much ſteeper than they are now. A remarkable ſtone of this ſort, whoſe weight may be from thirty to forty tons, and conſiderably rounded, reſts upon a narrow ledge of puddingſtone, below the farm of South Sannox, where the road is cut through. It is hardly credible that this ſtone could have rolled into its preſent poſition by accident. Its reſting on a pivot, and having its edge propped by a ſmall block of granite, ſeem to indicate that it was placed there by deſign. But how they could contrive to move ſuch a maſs, though found contiguous, or to elevate it to its preſent poſition, when mechanical powers were unknown,

unknown, exceeds my comprehenſion. This ſtone very much reſembles the rocking ſtones at Glen-nevis, and other parts of the North Highlands, ſome of which move by the wind, and by which the Druids pretended to foretel future events. Many of theſe ſtones have been thrown from their pivots, and can no longer be moved; and, whether this was a rocking ſtone or not, it was probably an implement of ſuperſtition.

A much larger maſs is ſeen reſting on rounded blocks, beneath which the laſt of Cromwell's ſoldiers is ſaid to have ſought concealment, but was there overtaken and ſlain.

The ſtrata ſouthward from the South Quarry harbour, are moſtly red ſandſtone, curiouſly interſected by cracks, or ſlips, which occaſion perpetual variations in the line of dip. Theſe ſtrata are often compoſed of thin laminæ, whoſe outcrops look like large fans, or like leaves of the palm-tree overlapping each other. They are interſected by numerous whinſtone veins. One large vein runs a long way from north to ſouth; then ſuddenly forms a curve, and runs eaſtward. It has a ſmaller vein, of a darker blue whinſtone, in the ſame chaſm, on its weſt ſide. The latter does not bend round with its aſſociate, but continues onward in a right line, and ſoon cuts a larger vein, at an angle of 45°, without intermixture of ſubſtance. It ſeems as if the firſt large vein diſdain-

ed

ed to travel further with ſuch a puny aſſociate, and hence he flies off from him at right angles; while the other, indignant, takes his revenge on the firſt great vein he meets, by cutting him in two.

But what is moſt remarkable along this beach, is numerous veins, of various dimenſions, ſome not thicker than a quarter of an inch, ſome ſeveral feet over, of red ſandſtone. Theſe veins are harder, and are either of a paler or deeper red, than the ſtrata which they interſect. Sometimes they are cut off, and ſometimes have their direction changed, by the whinſtone veins. When broken acroſs, they can be ſeen diſtinctly to penetrate the ſtrata, moſtly in a perpendicular, but ſometimes in a ſlanting direction. Where they are thin and numerous, they mark the ſurface of the ſtrata into many whimſical compartments. I noticed a vein of this ſort, as forming the key-ſtone of the Gothic arch of King's Cove. Near Arran Park, there is a projecting peninſula, forming the northern mouth of Broddick Bay, which exhibits many large veins of this ſort. At one place, a ſlip changes the red ſandſtone to white. A ſandſtone vein interſects both; which, before it leaves the red ſandſtone, has a mixture of white; but when it enters the white ſandſtone, it becomes wholly white.

DESCRIPTION OF THE STRATA

MENTIONED AND REFERRED TO IN

THE PRECEDING SURVEY.

BY DR WALKER.

THE late DR WALKER efteemed a knowledge of the folid ftrata of the earth the moft important part of Mineralogy; as in them the metallic ores, and all the more valuable minerals, are fituated. He arranged thefe under two grand claffes, the PETRÆ and SAXA. The firft forming the lower hills; the laft the higher mountains.

The PETRÆ he defined to be *fimple rocks*, foffils which are either craggy or ftratified, appearing to the naked eye to be compofed of one and the fame material.

The SAXA he defined to be *compound rocks*, foffils which are craggy or ftratified, amorphous, compofed

composed of a substramen and various concretions.

The PETRÆ he arranged under four orders, each order including a number of genera.

The SAXA he arranged under nine orders, each including a number of genera.

To each genus he affixed the name which had been used by Pliny and other ancient authors; but he was careful to note the synonymes which had been used by more modern authors, or which prevailed in the vulgar dialect of this and of other countries.

In describing the various genera, it was not his object to enumerate all the properties which belonged to each individual, (a practice which has lately rendered Mineralogy a mass of unintelligible jargon), but to select those discriminating characters by which one stone is distinguished from another.

The discriminating characters of fossils he arranged under the following heads; which, though not repeated in the following descriptions, are understood to be implied.

NATURAL CHARACTERS.
SITUATION.
SUBSTANCE.
CONSISTENCE.
FIGURE.
STRUCTURE.

PARTS.

PARTS.

QUALITIES.

CHEMICAL CHARACTERS.

In the preceding pages, all the peculiarities of the rocks are defcribed as they occurred. What follows is not a connected feries of Dr Walker's defcriptions of the genera of rocks, but a felection of his defcriptions, expreffing their general and difcriminating properties, moftly in the order in which the rocks occurred to me in Arran. Stones not included in his fyftem have already been defcribed, or fhall be defcribed afterwards.

Note [A.] SANDSTONE. p. 39.

SYMPEXIUM.

Scytheſtone or Rubber. *Woodward's* foſſils, Part I. p. 17—32. Saxum, 10. *Da Coſta*, p. 132. Grainſtone, *Brown's* Jam. p. 50. Arenarius granularis, *Waller*, Syſt. I. p. 195. Sandſtone with an argillaceous cement, *Cronſt.* § 276. p. 1. 3.

Engliſh: ſandſtone, grindſtone, ſeedſtone, crowſtone. Scotch: commonly called freeſtone.

Natural Characters.

Sit. Secondary. Strata horizontal, oblique, elevated, very thick.

Subſt. Aggregated. Subſtramen argillaceous. Concretions quartzoſe, micaceous.

Conſiſt. Cuts with a chiſel. Poliſh rude, dull, arenaceous. Does not tranſmit light. Fracture plain.

Fig. Amorphous.

Struct. Indeterminate, arenaceous.

Parts. Fragments of the Strata quadrangular. The quartzoſe particles, amorphous; the micaceous, ſilvery.

Qual. Colour white, whitiſh, grey; but, impregnated with ochre of iron, it is red, or yellow.

Chemical

Chemical Characters.

Resists the air, though it is sometimes decomposed by exposure to it. Vitrescible into a solid hard glass. *Waller.*

Note [B.] Red Ferruginous Clay or Shiver, p. 39.

Thyites.

Clayſtone, *Woodward*, II. p. 99. Schiſtus fragilis, *Waller*, I. p. 341. Argillaceous ſlate, *Born.* Engliſh ſill. Vulgo, primitive argillaceous ſlate.

Natural Characters.

Sit. Primitive. Strata vertical, elevated, fiſſile.

Subſt. Homogeneous, earthy, argillaceous. Often contains ſmall veins of quartz; but never extraneous foſſils.

Conſiſt. Does not tranſmit light. The ſtratulæ full of cracks, fragile. Pounded, its duſt is of the ſame colour, but more pale; ſometimes friable; aſſumes no tegmen.

Fig. Amorphous.

Struct. Indeterminate. Pecten ſcarce palpable.

Qual. Black, duſky, cinereous, red, yellowiſh, greeniſh.

Chemical Characters.

Crackles in the fire. With a ſtronger heat is melted into a frothy ſcoria. *Waller.*

Obſervation. Contains ſmall veins of quartz, but no extraneous bodies.

Note

Note [C.] MOLARIS and BRECCIA, p. 39.

MOLARIS.

Lapis molaris, *Valmont*, Sp. 144. Molaris, Scopoli Princip. p. 59. British millſtone.

Natural Characters.

Sit. Secondary. A coacervated rock, ſcarce ſtratified.

Subſt. Aggregated; ſubſtramen arenaceous; concretions rounded, angular, unequal, of various kinds.

Conſiſt. The ſubſtramen does not tranſmit light; the concretions often ſtrike fire with ſteel.

Fig. Amorphous; free of veins.

Struct. Indeterminate; but the concretions are often of a regular ſtructure.

Parts. The quartzoſe concretions are rounded; the ſchiſtoſe angular, together with the fragments of other primitive rocks; is the peculiar matrix of gravel, or ſmall ſtones.

Qual. The colour of the ſubſtramen is various; moſt frequently grey, or red.

Chemical Characters.

The ſubſtramen ſometimes effervefces; often grows harder by expoſure to the air.

Stomoma.

Saxum amnigenum, *Lin*. Breccia, *Waller*. I. p. 427. n. 3. The breccia of authors.

Natural Characters.

Sit. Secondary. Craggy, coacervated, ſometimes ſtratified, in beds variouſly inclined.

Subſt. Conglutinated; ſubſtramen ochreous; concretions of various ſtones, eſpecially the primitive; often ſchiſtoſe.

Conſiſt. Impervious to light; fracture rude; poliſh none; often exhibits holes.

Fig. Amorphous.

Struct. Indeterminate; fracture irregular, very rough.

Parts. Concretions often earthy, angular.

Qual. Subſtramen ſometimes red, often yellow; the concretions of various colours.

Note

Note [D.] BLOTTA. PRIMARY BRECCIA, or PUDDINGSTONE, p. 39.

BLOTTA.

Argillaria, *Brown's Jam.* p. 66. Balkſtone, *Born*, p. 112? Breccia arenacea, *Cronſt.*
Scotiſh till-band.

Natural Characters.

Sit. Secondary. A coacervated rock, ſcarce ſtratified.
Subſt. Subſtramen argillaceous. Concretions rounded, angular, of various ſpecies.
Conſiſt. Subſtramen impervious to light. Concretions often give ſparks with ſteel. Fracture irregular. Cement ſcarce palpable.
Fig. Amorphous.
Struct. Indeterminate.
Parts. Free of veins.
Qual. Colour of the ſubſtramen various; moſt frequently blackiſh, or grey.

Chemical Characters.

Moulders in the air. Inſoluble.
Obs. Free of veins.

Note [E.] GREY GRANITE, p. 41.

PSARONIUM.

Granitum, *Valmont*, Sp. 182. n. 3. Psaronium, *Da Costa*, p. 280. *Woodward's* foreign fossils, p. 4. Appendix, p. 4. Granites, *Waller*, I. p. 407.

British grey granite. English moorstone. Hard growan, Cornwall. Peasy whin, Aberdeen. Granitello, Italy.

Natural Characters.

Sit. Primitive. Strata vertical, very thick, very solid.

Subst. Conglomerated, water-borne. No apparent substramen. Concretions, fellspar, quartz, mica.

Consist. Gives fire with steel; very hard; does not obey the chisel. Fracture somewhat plain, rough. Polish like that of marble.

Fig. Amorphous.

Struct. Granulated with grains of various size and figure, sometimes however equal, very small.

Parts. Concretions of fellspar cubical, lamellated. Concretions of quartz amorphous. Concretions of mica lamellated. Fragments of the strata parallelopiped, of immense size.

Qual.

Qual. Fellſpar white; quartz more white. Mica black, ſometimes whitiſh. Fellſpar and quartz, ſubdiaphanous. Black mica opaque, white, pellucid.

Chemical Characters.

Hardens in the air. Moulders in the fire.

Obs. 1. Beſides black mica, white pellucid mica is often found in granite; which never occurs in ſyenite.

2. Powdery cryſtallyzed calcareous earth often exiſts in granite.

Note [F.] MICACEOUS SCHISTUS, p. 47.

LEPIDOTES.

Saxum fornacum, *Linn. Cronſt.* p. 242. Saxum tritorium, *Linn. Cronſt.* p. 244. Hornſlate, *Ferber*, p. 327. Lepidotes reſembles the ſcales of fiſhes, of various colours, *Agricola*, Nat. Foſs. Lib. 5. Saxa fornacum, *Waller*, I. p. 410. Saxum Mareſtrandenſe, *Linn.* Stone compoſed of quartz and mica, *Gusmanni* Lithophyl. Mitiſian. p. 443. Saxum Molinum Garpenbergenſe, Roeroſienſe, Montanum, *Linn.*

British: Scaleſtone. German (vulgo) gneiſs.

Natural Characters.

Sit. Primitive. Strata vertical, fiſſile.

Subſt. Conglomerated. Concretions, mica and quartz variouſly interwoven.

Conſiſt. The quartz gives ſparks with ſteel, the mica none. Does not obey the chiſel.

Fig. Amorphous.

Qual. The micaceous part is golden, ſilvery, greeniſh, blackiſh; the quartzoſe white.

Chemical Characters.

The extremities of the ſtrata, broken acroſs, long reſiſt the violence of the fire. Hence its name by Linnæus and Wallerius, from its uſe in the conſtruction of furnaces.

Note

Note [G.] RUBBLE, or BASTARD FREESTONE, p. 48.

SCYRUS.

Freeze, or Burſtone, *Da Coſta*, p. 127. Sandſtone with an unknown cement, perhaps argillaceous, *Cronſt.* § 276. n. 3. Cos cotaria, *Linn.* Rubble, or Rubbleſtone, *Kirwan.*

Scottiſh: commonly baſtard freeſtone; baſtard whinſtone. Engliſh: freeze. Elvan.

Natural Characters.

Sit. Primitive. Strata vertical, very thick.

Subſt. Conglutinated. Subſtramen ſcarce manifeſt, argillaceous. Concretions moſt frequently ſilicious, very ſmall, nearly equal; ſometimes micaceous, ſchorlaceous.

Conſiſt. Gives ſparks with ſteel. Does not obey the chiſel.

Fig. Amorphous.

Struct. Indeterminate, arenaceous. Fracture angular, irregular. Pecten palpable.

Qual. Its moſt frequent colour reddiſh.

Note

Note [H.] WACKEN PORPHYRY, p. 61.

GLOMELLARIA.

Scottiſh : Ratchell.

Natural Characters.

Sit. Primitive. Strata vertical, thick.
Subſt. Conglutinated. Subſtramen, earthy, argillaceo-ſchiſtoſe. Concretions, quartz, fellſpar, ſchorl; ſometimes zeolite, angular.
Conſiſt. Impervious to light; brittle; does not obey the chiſel. Poliſh, none.
Fig. Amorphous.
Struct. Indeterminate. Fracture angular, rough. Pecten ſcarce palpable.
Parts. Fragments of the ſtrata amorphous.
Qual. Subſtramen blackiſh, dark grey, aſh-coloured. Concretions white, ſhining.

Note

Note [I.] SYENITE, p. 62.

[This ſtone is ſo called from Syene in Upper Egypt, where it abounds. The ancient Egyptians conſtructed many of their temples and obeliſks, adorned with hieroglyphicks, of this ſtone. They even cut large rocks of it into gigantic ſtatues. If a monument is to be erected to our naval heroes, the baſe, at leaſt, ſhould be of this ſtone; that when the column itſelf has mouldered into duſt, the baſe may tranſmit their glory to poſterity. It abounds at Sandſide in Caithneſs, and many other parts of Scotland.]

SYENITES.

Syenites, *Plin.* Lib. 36. cap. 8. Granites Orientalis, *Waller*, I. p. 407.

Britiſh: Syenite. Red granite. Granito roſſo of the Italians.

Natural Characters.

Sit. Primitive. Strata vertical, very thick, very ſolid.

Subst. Conglomerated, water-borne. No manifeſt ſubſtramen. Concretions fellſpar, quartz, mica; ſometimes cryſtallized ſchorls.

Fig. Amorphous.

Struct.

Struct. Granulated, with grains of various magnitude and figure.

Parts. The concretions are sepɼrable by a blow. Concretions of fellspar are quadrangular lamellated. The concretions of quartz are amorphous. The concretions of mica are lamellated. The fragments of the strata are parallelopiped, of immense size.

Qual. The fellspar is red; quartz, white; mica black. The fellspar is slightly translucent; the quartz, subdiaphanous; the mica, opaque.

Chemical Characters.

Stands the fire; afterwards gives sparks with steel. Vitrifiable into a white semipellucid glass. The iron with which he fellspar is coloured, in a vitrifying heat, becomes volatile. Insoluble in acids.

Obs. Large, yellow micaceous concretions, of a rhombic figure, are sometimes found in syenite, which are never found in granite.

Note

Note [K.] Basaltic Columns, p. 77.

Basaltes.

Basaltes, *Plin.* Lib. 36. cap. 7. *Pott.* Lith. II. p. 219. Pierre de Stolpen, *Valmont*, vol. I. p. 134. Hill's Theophrastos, p. 111. Black columnar porphyry of Ireland, *Brown*'s Hist of Jam. p. 49. Basaltes, *Boethius* de gemmis, Lib. 2. cap. 273. *Hill*'s Hist. p. 467. Marmor Stolpense, ferreo colore et duritie, *Kentmanni* Nomenclat. p. 53. Basaltes, a stone which consists at least of four angles, and at most of seven. *Gesner* de figuris lapidum, p. 20. Black granite, *Forster*, p. 22. Basaltes, *Woltersdorf*, p. 19. Basaltes, *Bergman*. Act. Upsal. Nov. vol. III. p. 22. Basaltes columnaris, *Baumer*. Regn. Min. p. 236. Basaltes, *Worm.* Mus. p. 44. Basaltes, *Agricola* de Nat. Foss. Lib. 7.

English: Basalt.

Nat al Characters.

Sit. Primitive. Stratified in beds horizontal or oblique, very thick; with vertical angular fragments.

Subst. Aggregated. Substramen, earthy, schistose, black, or ash-coloured. The concretions are quartz or schorl, small, sometimes mica, interspersed.

interſperſed. Concretions of ſpar and zeolite are adventitious.

Conſiſt. Impervious to light, very hard, reſiſts the chiſel. Poliſh, ſcarce approaches to that of marble. Fracture, ſomewhat plain, ſomewhat rough.

Fig. The fragments of the ſtrata are columnar, priſmatic, for the moſt part hexagonal, contiguous, not adhering; with unequal ſides. The columns are continuous or jointed, of all figures, from trihedral to octohedral. The moſt common figure is hexahedral.

Struct. Indeterminate. Sometimes ſcarce palpable.

Parts. The ſides of the columns are plain, ſtraight, ſometimes curved.

Qual. Colour, black or grey. Is attracted by the magnet. Specific gravity 3000, *Bergman.* Rings when ſtruck.

Chemical Characters.

Vitrifiable in a violent heat. Its glaſs is ſcoriform, black, compact, giving fire with ſteel. Incalcinable, *Pott.* In the fire fuſible by itſelf, *Bergman.* Inſoluble in acids. By roaſting grows red. By fixed alkali vitrifiable into a black, or blue, opaque glaſs.

Compoſition

Composition—	Silicious earth	-	56
	Argillaceous	-	15
	Calcareous	-	4
	Iron	- -	25
	Bergman	-	100

Obs. It wears metals by writing, and shows their colours. Hence its use as a touchstone.

Note

Note [L.] FATISCENT WHINSTONE, p. 85.

AMYTHON.

Amiantine Rock.

Natural Characters.

Sit. Primitive. Strata vertical.

Subst. Aggregated. Subſtramen ſchiſtoſe. Concretions, amianthus, aſbeſtus; eſpecially amianthus interwoven. *Linn.*

Conſiſt. Impermeable to light. Fracture rude, rough. Poliſh, none.

Fig. Amorphous.

Struct. Indeterminate. Pecten ſcarce palpable. Concretions fibrous, or radiated.

Qual. Colour approaching to black, dark.

Note

Note [M.] WHINSTONE, or BASALT, p. 96.

SIDEROPOECILON.

Saxum cotarium, *Waller*, I. p. 417. Saxum cotarium, *Linn.* Saxum ferreum, *Waller*, I. p. 420. Basaltes amorphus, *Baumer*. Regn. Min. p. 236. Mullenstone, *Kirwan*'s Elem. I. p. 225. Kraggstone, *Kirwan*'s Elem. I. p. 226.

Scottish: Whin, Whinrock, Whinstone.

Natural Characters.

Sit. Primitive. Strata vertical, lofty, thick.

Subst. Conglutinated. Substramen earthy, schistose. Concretions schorl, quartz. Concretions of mica, fellspar, zeolite, adventitious.

Consist. Impervious to light, very hard, resists the chisel. Fracture angular. Polish rude.

Fig. Amorphous.

Struct. Indeterminate. Pecten scarce palpable.

Parts. Fragments of the strata vertical, elongated, angular. By exposure to air and water, it acquires a whitish tegmen, or crust.

Qual. Colour black, dark-blue, ash, whitish. Rings when struck.

Obs. 1. Is often the matrix of metallic veins.

2. In the illuſtrious Electoral Muſeum of Dreſden, ſtones of this genus are diſtinguiſhed by Pliny's name of Syderopœcilon.

Note [N.] PORPHYRY, p. 125.

LEUCOSTICTOS.

Porphyr. *Valmont*. Sp. 180. Porphyrites, *Plin.* Lib. 36. cap. 7. Porphyr. *Waller*. Syſt. I. p. 414. Porphyry, *Kirwan*'s Elem. p. 151. Leucoſtictos, *Cesalpinus* de Metall. Lib. 2. cap. 16. Leucoſtictos, *Plin.*

British: Porphyry.

Natural Characters.

Sit. Primitive. Strata vertical.
Subſt. Aggregated. Subſtramen water-borne, jaſpidean, but harder. Concretions diſſeminated; of fellſpar quadrangular, angular; ſometimes of quartz, ſchorl, rarely of mica.
Conſiſt. Subſtramen gives fire with ſteel; is harder than jaſper; not cut with ſteel. Fracture ſomewhat plain, dull. Pecten impalpable. Poliſh perfectly jaſpidean, ſhining, the concretions excepted.
Fig. Amorphous.
Struct. Of the ſubſtramen indeterminate.
Qual. Colour red, inclining to purple, black, green. Subſtramen ſubdiaphanous, or tranſmits a very little light at the edges.

Chemical Characters.

The substramen is untouched by acids, even when invigorated by heat. Is more easily fused in the fire than jasper itself. Forms an opaque, compact glass; *Waller*. It remains, however, entire in a fire, in which jasper is fusible; *Pott*. Vitrescible, its glass scoriform, dark.

Note [O.] SLATE, STEGANIUM, p. 204.

STEGANIUM.

Fiſſilis menſalis, *Auctor.* Schiſtus cœruleſcens, durus, clangoſus ex Scotia, *Gronov.* Ind. p. 10. n. 10. Schiſtus purpureus, *Da Coſta*, p. 175. Schiſtus cœruleus, *Da Coſta*, p. 181. Saxum fiſſile cœruleum, *Sibbald. Auctor.* p. 35.

British Slate. Table Slate.

Natural Characters.

Sit. Primitive. Strata vertical, fiſſile.
Subst. Homogeneous, earthy, ſchiſtoſe.
Consist. Tranſmits no light, cuts with a knife. Longitudinal fracture plain; tranſverſe rude, angular. Writes white. Poliſh very ſlight, dull.
Fig. Amorphous.
Struct. Indeterminate. Pecten impalpable.
Parts. Fragments of the ſtrata quadrangular, rhomboidal, fiſſile, parallel; the ſides being plain, ſmooth, even.
Qual. Blue, black, purple. Rings when ſtruck.

Chemical Characters.

Impervious to water. Fuſible; paſſing into a ſcoria that floats in water, and even in ſpirit of wine. Urged by a ſtronger heat, it paſſes into a more denſe ſcoria. *Walter.*

Composition. Silica, magneſia, lime, iron; with a ſmall portion of mineral oil. *Kirwan.*

Note

Note [P.] ARDESIA, p. 204.

[Though I ſaw no Ardeſia in Arran, I ſhall take the liberty of ſubjoining Dr Walker's deſcription of it, that the reader may ſee in what particulars it differs from ſlate, to which it is very nearly allied. There are inexhauſtible quarries of Ardeſia at Eiſdale, Balahuliſh, and other parts of the Weſtern Highlands. Slate generally riſes in broader plates than Ardeſia. In Cornwall and Wales, there is much ſlate; but I never heard of Ardeſia in theſe places. The beſt ſlate is equal in durability to the beſt Ardeſia, though the former is ſubject to greater variations in quality than the latter.]

ARDESIA.

Ardeſia tegularis, *Waller*, I. p. 337. Schiſtus Ardeſia, *Linn.* Greeniſh, gloſſy, talky ſlate, *Woodward.* Foss. Part I. p. 18. n. 80. Schiſtus viridis, *Da Costa*, p. 182. Schiſtus ſprinkled with yellow pyrites from Scotland, *Gronov.* Ind. p. 10. n. 11.

Scottiſh: Skailzie.

Natural Characters.

Sit. Primitive. Strata vertical, fiſſile.
Subst. Homogeneous, earthy.

 Consist.

Consist. Tranſmits no light; cuts with a knife. The longitudinal fracture plain; the tranſverſe rude, angular.

Fig. Amorphous.

Struct. Determinate. Pecten palpable. Surface of the plates undulated, furrowed, ſtriated, or punctured; faintly ſhines.

Parts. Fragments of the ſtrata quadrangular, rhombic, large.

Qual. Blue, greeniſh, black. Rings when ſtruck.

Chemical Characters.

Impervious to water. Is not decompoſed by the weather.

Obs. It contains cubical, yellow, cryſtals of iron pyrites, ſcattered at a diſtance from each other.

GENERAL

GENERAL REMARKS.

I. *On the* GRANITE MOUNTAINS, TOPAZES, &c.

THE granite mountains of Arran occupy an area of from eight to ten miles from north-eaſt to ſouth-weſt, and from five to ſix miles in the oppoſite direction. Their ſouthern baſe exceeds ſix miles in length; but the northern ſide does not much exceed three. We ſhall aſſume their area to be a parallelogram, of eight miles by five, which gives forty ſquare miles occupied by the granite mountains. Were actual meaſurement applied, I doubt not but theſe mountains would be found to occupy a larger area than that here aſſigned.

The different varieties of granite have been deſcribed as they occurred. With regard to the veins of granite mentioned by Mr Playfair, (Illuſtrations of the Huttonian Theory, p. 314.), as penetrating the ſchiſtus, I ſaw no ſuch veins, nor any veins of granite but ſuch as I have deſcribed, interſecting the granite mountains themſelves. Nor did the granite of ſuch veins, except in its mode of arrangement, and the ſuperior ſize of its maſſes, ſeem to differ in ſtructure from the granite contiguous to them. The only exception to this obſervation, are the two very curious veins of granite

granite included in the vein of whinſtone, in the channel of Roſa Burn, deſcribed p. 54. At the junction of the granite with the ſchiſtus in the mountain of Tornidneon, no regular vein of granite was ſeen in the ſchiſtus; though many detached maſſes of granite were found in the ſchiſtus, and ſome detached pieces of the latter in the former. Though I often looked for the veins deſcribed by Mr Playfair, I ſaw none; but I ſuſpect I had not been fortunate enough to ſtumble on the places where he found them.

It has been obſerved, that veins of talk, by ſome called mica, occur in theſe mountains; and that ſilicious cryſtals, of various degrees of perfection, from the firſt rude approach towards a regular form, to the perfect topaz, are found diſſeminated in blotches, or veins of quartz.

But ſilicious cryſtals, generally of a ſmoky colour, and five-ſided, terminating in pyramids at both ends, are often found in the body of the granite itſelf. The ſize of theſe has always a reference to the ſize of the cryſtals of fellſpar, with which they are connected; the largeſt being found in thoſe parts of the granite where the fellſpars are largeſt.

The largeſt and moſt perfect of theſe cryſtals are found in what the people here call *rotten rock*; and theſe are always of a ſmoky colour. This rotten rock is an incruſtation of thoſe large cryſtals

ſtals of fellſpar, which have improperly acquired the name of adularia *(flattering.)* Though many of the adulariæ remain entire, a conſiderable proportion of them has mouldered down into an earthy maſs, of a yellowiſh colour, and a ſlight adheſion, which has occaſioned the name affixed by the people to this incruſtation. Theſe incruſtations are found adhering to the cheeks of veins, or rents, in the granite mountains, or inveſting hollow cavities in the granite rocks. Though the cryſtals are placed in every poſſible direction, and croſs each other at various angles, they have always their broadeſt apex more or leſs projected from the cruſtaceous baſe in which they are inſerted. Their general figure is pentagonal, terminating in pentagonal pyramids, their ſides tranſverſely ſulcated, the pyramids ſmooth; but not unfrequently two or more cryſtals are indented into each other, which occaſions a greater number, and irregularity in the breadth of the ſides. It alſo occaſions an irregularity in the ſhape of the pyramid; and not ſeldom a tendency towards two or more pyramids in the ſame cryſtal. In ſuch caſes, ſmall black flakes, and a fibrous appearance, reſembling a moſſy vegetation, are often viſible in the centre of the pyramid. Theſe incruſtations are eaſily ſeparable from the ſolid rock to which they adhere, and are always moulded by its ſhape; which clearly ſhews that they are adventitious, and

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that they have been formed in these situations by infiltration, or by slow deposition from some menstruum. We can form some idea of this from the formation of incrustations, and of spar of lime, in cracks, and caverns of rocks, which are unquestionably produced by infiltration; as we see them, in many places, in the very act of formation. The coalpits of Swinridgemoor in Ayrshire, afford another illustration, where incrustations of silicious crystals are actually forming, or formed, upon the till-roof of the old wastes. That district abounds with strata of silicious sandstone, similar to the French burr-stone; and these strata contain many petrifactions of wood, converted into flint, though the bark is converted into a coaly bitumen. The wood could not have been so completely changed, without the infiltration of the silicious matter into its pores; and the crystals in the old wastes must be formed from silicious matter, conveyed by aqueous solution, and either deposited in the form of a splintery crust, or shooting into pyramidal crystals. No such crystals are found in those places from which the coal has been recently extracted.

What seems to prove that the adularia had been formed from the decomposition and subsequent crystallization of the fellspar in the granite rocks, and the topazes from the silicious matter in the same rocks, is, that these two species of crystals

ſtals uniformly bear a relative proportion to each other in point of ſize. When the adularia are of large ſize, the topazes are alſo large; and when the one is ſmall, the other is alſo ſmall; and in the laſt caſe, neither of them are ſo regular as in the firſt. This ſeems to indicate the different degrees of ſlowneſs, and freedom from perturbation, by which they had been formed. It is well known that the ſize and regularity of cryſtals are much affected by theſe cauſes. Where the adularia remain entire in theſe incruſtations, they are always of a white colour, and ſeem to affect the rhomboidal figure. Perhaps the earthy matter of the cruſt may be fellſpar depoſited without cryſtallization. Both ſpecies of cryſtals ſeem to have been formed at the ſame time, and to have been ſeparated from the ſame liquid.

Theſe ſmoky topazes abound in Cairngorum as well as in Arran. Heating them carefully in a ſand-bath, is ſaid to convey to them the bright yellow colour of the oriental topaz. Hence ſome have ſuppoſed their ſwarthy colour to be owing to carbon in the body of the ſtone, which the heat deſtroys. I am rather diſpoſed to impute their dark hue to oxyd of iron, which the heat, in ſome degree, deoxydates or changes, ſo as to make it tranſmit and reflect a different colour. To the ſame cauſe, and not to carbon, I am diſpoſed to impute the dark colour of pitchſtone.

For

For my ingenious friend Dr Thomſon having heat-ed ſpecimens of it in a furnace, with acceſs of air, with a view to burn off the carbon which is ſup-poſed to convey its colour, found its ſurface and cracks in ſome caſes acquired a yellowiſh brown, or ruſty colour, evidently from an alteration of the ſtate of oxyd of iron; while the interior parts of the ſtone remained unchanged. A ruſty in-cruſtation is often ſeen to cover the pitchſtone of Arran, and to penetrate its cracks, acquired by expoſure to the air alone; becauſe the interior parts are a bottle green, of various intenſity.

The concluſion ſeems therefore warranted, that the topazes, as well as the pitchſtone, of Arran, owe their colour to iron in their compoſition, in a particular ſtate of combination with oxygen.

We already adverted to the vaſt maſſes of gra-nite which are found among the mountains, or on the ſea-ſhore contiguous to the granite mountains. Similar maſſes are found along the ſummits of the ſecondary mountains, towards the ſouth, and a-round the ſea-ſhores not only of Arran, but of Holy Iſland. But I remarked of theſe maſſes, in general, that the further they are removed from the granite mountains, the ſmaller they are in ſize, and the more rounded they are in ſhape. Some blocks on the ſhore at South-End are globular. It is evident that theſe blocks muſt have come into their preſent poſition, before the waters had ſcoop-

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ed out thofe deep ravines, which now feparate the granite mountains from each other, and infulate the whole group of thefe mountains from the other mountains in Arran. Thefe facts lead back our thoughts to a very remote period, when the ifland was, perhaps, much more extenfive than it is now; when the granite mountains were much more elevated, and the ifland floped from them in all directions; when ftreams of water diverged from them, as from a centre, and rolled thefe blocks, in all directions, towards the extremities of the ifland.

On Cairn-table, the mountains of Glefpin, and others between Muirkirk and the vicinity of Lead-hills, rounded blocks of granite, and of fyenite, are found, and in the channels of the waters which interfect them, though no rocks of thefe materials are found there. But thefe blocks muft have come from mountains of thefe materials, at a remote period, when the furface floped, and ftreams of water flowed, from the granite towards thefe fecondary mountains. Similar examples might be adduced from other places, though thefe feem fufficient to illuftrate the opinion here advanced.

Granite is probably the oldeft rock now in exiftence, and its formation feems to have preceded that of animals and vegetables; becaufe no organized remains are found in it. But the facts

which

which occurred in Glen Rofa, and others which might be adduced, feem to prove that other rocks preceded its exiftence. Perhaps Dr Walker makes too many primitive mountains; and, in place of the word primitive, I am difpofed to fubftitute the word primary; indicating, that fome rocks are older than others, but that none are primitive in an abfolute and unconditional fenfe.

II. On Micaceous Schistus, or Lepidotes.

These mountains have been defcribed as invefting the granite all round, and forming a fort of elevated terrace projected from their fides. On the weft and north they are extended to a much greater diftance than on the eaft and fouth-eaft. Oppofite to thofe tremenduous chafms, or corrys, which are excavated in the granite mountains on the eaft, the barrier of fchiftic rock, as far as vifible, is generally very thin, in fome places only a few feet over. Hence I have ventured to afcribe thefe excavations to the lateral preffure of great maffes of water, confined within the granite, when the mountains were much higher than they are now, which had burft its barriers, and carried out the fides of the mountain.

The Huttonians regard granite 'as a ftone of 'more recent formation than the ftrata incumbent

'on

'on it; as a ſubſtance which has been melted by
'heat, and which, when forced up from the mi-
'neral regions, has elevated the ſtrata at the ſame
'time.' (Illuſtration, &c. p. 84.)

By the ſtrata incumbent on granite, they muſt mean micaceous ſchiſtus, for I never ſaw any other ſtrata come in contact with granite but thoſe of this genus. I obſerved many places where the granite comes in contact with the ſchiſtus, in Arran; but their line of junction is concealed by ſoil and herbage, or by looſe blocks of ſtone. On the north ſide of Tornidneon, and on the ſouth ſide of Glen Catacol, their junction is diſtinctly ſeen, in perpendicular rocks of great elevation. The firſt I have attempted to deſcribe; and the ſecond, as far as my opportunity of obſerving enabled me to form an opinion, ſeemed ſtill more effectually to exclude the idea of the one rock reſting on the other. The further the ſchiſtus was removed from the granite, the more its ſtrata were inclined towards it; but near the junction, they were abſolutely perpendicular, or, by ſtrange contortions, bent backwards, as if afraid to face the granite. But in Catacol, as far as I could obſerve through exceſſive rain, and the glimmer of twilight, the line of junction ſeemed a perpendicular ſection from the top to the bottom of the mountain.

Mr Playfair's mathematical abilities are certainly of the firſt eminence; and, with the moſt humble deference to that talent in which all acknowledge his great ſtrength lieth, I cannot help regreting to ſee him making ſuch large encroachments upon his mathematics, in order to make his fire, or heat, or whatever he pleaſes to call it, operate exactly in the way his theory requires it to act, and in no other.

That *action* and *reaction* are equal and contrary, I conceive to be a law of nature, or rather a law impoſed upon matter by the Being who created it. If there be a great expanſive power exiſting in the centre of the earth, whether produced by heat, or any other cauſe, its reaction muſt be equal on all points of the ſolid cruſt with which it is environed. If, then, by any ſudden increaſe of this expanſive power, from cauſes which Mr Playfair has not choſen to explain, the expanſion ſhould take into its head to burſt its barriers, and to ſpew out granite mountains, whinſtone or metallic veins, or any other product that might ſuit its fancy; were its operations not wholly directed by whim and caprice, we might expect it would pay ſome deference to the known laws of nature, and make its greateſt eruptions where the reſiſtance was leaſt. Hence we might expect to ſee granite mountains bolting more frequently through ſandſtone and other ſtrata, than through micaceous ſchiſtus.

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A ſolid maſs of micaceous ſchiſtus, from its toughneſs and tenacity, is certainly calculated to give much more reſiſtance to a force acting from below, than any other ſtrata with which I am acquainted. It is more brittle at the quartz with which it is interſperſed; but by hypotheſis, theſe quartz were projected into it by the ſame heat which elevated the granite. That it was a ſolid body, and not a pulpy maſs, when this wonderful elevation took place, appears from the hypotheſis; becauſe, on the latter ſuppoſition, they cannot account for the ſtrange fractures, diſlocations, and irregularities of the ſchiſtic ſtrata.

But ſuppoſing this rock only to oppoſe an equal, or even a leſs, reſiſtance, to the expanſive force of heat, than other rocks: as the cruſt which compreſſes their expanſion, muſt be of very various thickneſs and preſſure, I really wiſh our theoriſts would explain their *taliſman*, their *arcanum magnum*, by which they contrive to make the expanſive power of liquid granite to react againſt this rock alone, and againſt no other. Theſe are myſteries which, to my weak capacity, ſeem incomprehenſible. I have looked for explanations of them, but have found none.

There are others, which, in my apprehenſion, even darken darkneſs. In Arran, whence came theſe veins of porphyry, of whinſtone, of pitchſtone, of pitchſtone porphyry, which interſect the

granite mountains to their fummits, and are generally more regular than fimilar veins in the lower parts of the ifland? Our theorifts fay they were belched up by the expanfive power of heat. This muft have happened either at the fame time that the granite was elevated, in a liquid mafs, or after the granite had confolidated into mountains.

If thefe fubftances were elevated in a liquid form, along with the granite, they muft have been completely intermixed; and I do not fee any power, fhort of a miracle, which could have feparated them, and arranged the granite in ftrata, and the others in veins, fo diftinctly marked and difcriminated from the granite.

If the fubftances which fill thefe veins, erupted after the granite had cooled into folid rock, I do not fee by what caprice they perfifted in forcing their way to the fummit, againft fuch tremendous refiftance, when they might fo eafily have avoided fuch an unequal conflict, by forcing a retreat through the fides of the mountains. By the laws of fluids, their forcing a paffage to the fummit, againft folid rocks, or even in open vacuities, where they had little or no lateral refiftance, is utterly impoffible.

Here, again, fome talifmanic influence muft be employed to direct the expanfive force of the matter which fills thefe veins, againft granite, while its neighbour, the micaceous fchiftus, is fpared.

In

In Arran, the schistic rocks are intersected by whinstone veins, more similar to those I had been accustomed to observe, than many others which intersect the strata in other parts of the island. But neither here, nor any where else, did I observe either pitchstone, or porphyry, to intersect the schistus, though they intersect the granite, and the sandstone.

Another difficulty occurs. Our theorists assert, that those blotches, and columnar strata of basalt, which abound in Arran, and which rest either on indurated stratified clay, or sandstone, had been belched up from below, and spread, in a liquid form, on the strata which they cover. Certainly, if the basaltic materials which now occupy the veins in the schistic rocks, and, still more, those in the granite, had been belched from below, they would more naturally have escaped by the sides, than have ascended to the summits, of these mountains. Had this been the case, we might have flattered ourselves with seeing colonnades, or at least blotches, of basaltic rock, resting on the sides, or in hollows, of schistic and of granite mountains. Such things may be; though I never saw them, or even the slightest symptom of them. In Lewis, indeed, I saw basaltic veins, running in micaceous schistus, which had assumed, in some parts, the columnar form. But such columns did not rise above the surface, and were not perceived,

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except where ſtreams of water had formed excavations in the vein, and the ſchiſtus formed a wall on each ſide of the columns.

But it is time to attempt a retreat from the difficulties which environ the igneous theory, and to enter upon a further expoſition of facts.

Slate always forms veins, or compartments, in the ſchiſtic mountains, and ſeems only to differ from them in the greater regularity of its laminæ, and in containing a ſmaller proportion of quartz, and of mica. It ſeems pretty certain that the ſlate and the micaceous ſchiſtus were formed at the ſame time, and by the ſame proceſs of nature. I have ſeen examples, though not in Arran, of vegetable impreſſions, and very diſtinct ones of ſkeletons of fiſhes, in ſlate. Though ſuch occurrences are very rare, I flatter myſelf they warrant a concluſion,—that the ſchiſtic mountains have been formed at a much later period than thoſe of granite, and that the formation of the former was poſterior to the exiſtence of plants and fiſhes, though it ſeems to have preceded the great multiplication of theſe organized bodies.

With regard to the mode by which theſe rocks were formed, I conceive their formation would firſt commence upon the granite; that the quartz, which I would rather chooſe to call ſilicious ſpar, would firſt ſeparate from the liquid, and form tabular

bular maſſes, on which the ſchiſtus would depoſit; or nuclei round which its laminæ would ramify.

The ſchiſtic rocks have been formed, partly from cryſtallization, partly from depoſition, though the cryſtallization is not ſo perfect as that of granite, nor the depoſition ſo regular as that of other ſtrata. With regard to ſlate, it ſeems to have been formed wholly from depoſition; and its ſtrata are always regular, except when maſſes, or veins, of ſilicious ſpär occur; and theſe, to a certain extent, occaſion the ſame irregularities in its ſtructure, which they produce in the ſchiſtic rocks, of which they are a part.

III. *On the* Breccia *or* Puddingstone, Sandstone, &c.

I have diſtinguiſhed two varieties of this ſtone, the firſt of which I have called primary, the other ſecondary.

The firſt lies next to the ſchiſtic rocks, though it does not encloſe them all round, as theſe do the granite. It forms a chain of detached hills, running parallel to the ſchiſtic rocks, from the head of Glencloy to the mouth of the Iorſa. From this a branch runs down through the centre of the ſouth hills, and the ſtrata riſe towards it all round, as they do towards the ſchiſtic rocks in other places. In

In ſome places detached maſſes of it occur; and a vein, or irregular blotch of it, was deſcribed, occupying a chaſm in the granite above Currie. This is the moſt ſingular circumſtance that occurred reſpecting the poſition of this rock; for, in all other caſes, it was placed beyond the ſchiſtic rocks.

It is difficult to penetrate this rock, ſo as to obſerve its internal conſtruction. But, eaſt from Arran caſtle, large fragments of it had been blaſted, in order to clear the land. I obſerved that its ground, or ſubſtramen, was ſchiſtic earth, of a bluiſh grey colour, or concreted granitic ſand, generally white, but ſometimes a little ruſty. Often theſe two ſpecies of ground formed irregular, and parallel layers, in the ſame ſtone.

The concretions, or ſtones, included in this rock, are of all ſizes, and ſome are very large. They are generally angular, or not much rounded. Thoſe I obſerved are, granites, micaceous ſchiſtus, ſilicious ſpar, whinſtone. Large round blocks of ſilicious ſpar often occur, ſimilar to thoſe which abound in the ſchiſtic rocks.

As theſe rocks are compoſed of fragments of the granite and ſchiſtic mountains, their formation ſeems to have been next in order to that of the latter; and they were probably formed when the ſea waſhed the ſides of the granite mountains.

The ſecondary, or ſtratified puddingſtone, is much more various in its ſtructure. Its beds are

of

of various, and ſome of enormous thickneſs. As it often alternates with red ſandſtone, it muſt be regarded as of the ſame formation with the ſandſtone. In ſuch caſes, its beds often do not exceed a foot in thickneſs.

The ground of this ſtone is generally an arenaceous ferruginous clay, of various, but commonly of great hardneſs. Near Laggantwine, and other places, the ground is indurated chalk.

Its concretions, or the ſtones it includes, are ſometimes large, but generally of ſmall ſize, and very much rounded. Theſe are round jaſpers; ſilicious ſpar, commonly ferruginous, but often white; granite; micaceous ſchiſtus. In many caſes rounded flints occur, which are white to the heart like chalk; though ſometimes the flints are blackiſh, or brown, in the heart. In many caſes agates, calcedonies, and various ſtones which are uſually poliſhed for ornament, are frequent. Nodules of pitchſtone alſo occur, eſpecially towards the ſouth end. Rounded and angular fragments of ſyenite are frequent in theſe rocks; for which Mr Jamieſon accounts, as he found this rock *in ſitu*. Pieces of ſlate, and laminæ of ſandſtone, are frequent in theſe rocks, from Laggan to Laggantwine; and in moſt of them, rounded fragments of red, and frequently of white ſandſtone, often occur.

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Where maſſes of this ſtone have fallen aſunder, the fracture frequently, though not always, interſects the concretions.

At a place between Currie and Arran Caſtle, where they were quarrying ſtones for building, a ſtratum of puddingſtone was interpoſed between two ſtrata of red ſandſtone. The ſandſtone below was very little marked by the rounded pebbles of the puddingſtone; while the ſtratum above, when removed, exhibited round holes, or cells, correſponding to the projecting pebbles of the puddingſtone. In a few other caſes, where alternate ſtrata of pudding and ſandſtone were ſeen in ſection, the lower ſurface of the puddingſtone exhibited vacuities between its pebbles, ſhewing that they did not much impreſs the ſandſtone; while the ſandſtone ſtratum above, filled up every interſtice between the pebbles. Though it would be raſh to draw general concluſions from a few individual facts, yet it appears that, in theſe caſes at leaſt, the ſtrata had not all been conſolidated at once, by a ſudden increaſe of ſubterraneous heat, but that they had been conſolidated ſucceſſively, in the order in which they had been ſpread over each other; the one below being hardened into rock, before the one above it had been ſpread upon its ſurface.

A circumſtance is viſible at the Scriden rocks, and other maſſy ſtrata of puddingſtone, which I had

had formerly ſeen exemplified in the mountain of Morven in Caithneſs, which is compoſed moſtly of coarſe puddingſtone. This is large rounded blocks of puddingſtone, compoſed of ſmaller rounded pieces, which are alſo a concretion of rounded pieces. Sometimes the larger block includes a ſmaller block, and this a third, all compoſed of rounded ſtones. We have thus puddingſtone of the firſt, ſecond, and third formations.

This clearly ſhews that the ſecondary ſtrata have undergone at leaſt three revolutions, before they were arranged in their preſent form.

The ſtrata of pudding and ſandſtone have always two inclinations, one from the primary mountains, which is their line of bearing, or outcrop; the other at right angles to this; and the line of dip is the diagonal between theſe lines. North from Sannox the ſecondary ſtrata have more or leſs of a northern dip, with a few exceptions; and all ſouth from this, dip more or leſs towards the ſouth. The ſtrata contiguous to the primary mountains are ſometimes perpendicular, and always form a higher angle with the horizon than thoſe more remote. Were they of equal thickneſs throughout, it is evident that this would cauſe angular ſpaces to be left unoccupied. But there are ſome opportunities of ſeeing that they thicken as they deſcend.

Mr Playfair denies the poſſibility of parallel ſtrata of puddingſtone or ſandſtone being formed

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on a furface of great inclination; becaufe water could not arrange the materials in a parallel form, in fuch a pofition. Without entering into any difpute concerning the caufe that produced the elevation of thofe ftrata that now form a very high angle with the horizon, and which, apparently, had not been formed in their prefent pofition; I fhall only ftate, that I have feen banks of fand and gravel arranged in regular parallel ftrata, which formed confiderable angles with the horizon. Often in fuch ftrata are troubles feen to occur, fimilar to thofe in fandftone ftrata; and fometimes even flips or fhifts take place, where the correfponding ftrata are elevated, or depreffed, though the alternate beds ftill continue to be regular. I fhall only fpecify one example, becaufe it affords a lively reprefentation of the ftrata in Arran, though the ftrata do not form fo high an angle as thofe near the primitive mountains. It is a bank of gravel and fand near the mill, about a mile north from the church of Kilfinnan, in Cowal, Argylefhire. This is a bank of fand and gravel, which has been laid open by taking materials to form the road. It confifts of gravel and fine red fand, arranged in alternate ftrata, which are perfectly regular and parallel, and which dip towards the north at an angle of about 30°. Thefe ftrata have acquired a fmall degree of confolidation; and they prove that ftrata may be formed by wa-

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ter, not only perfectly regular and parallel, but even placed in an angular pofition. Like the ftrata of gravel in this bank, the puddingftone ftrata of Arran always alternate with red or brown, but never with white fandftone. Where groups of white and red ftrata occur, I faw no puddingftone.

Next to the primary puddingftone, I am difpofed to place, in the order of formation, the ftratified pudding, red fandftone, and thofe ftrata of the white fandftone which often alternate with the red. In thefe ftrata I never could trace the fmalleft veftige of animal or vegetable impreffions. But fuch might have been depofited among the materials, though afterwards obliterated by the fucceffive erofions and recombinations to which they have been fubjected.

Next in order I would place the white, grey, yellow, blue, and other fandftone ftrata which ufually cover coal; together with the coal itfelf, blaes, bituminated ironftone, and all the ftrata ufually denominated coal metals. Thefe muft have been formed after the earth's furface had been amply clothed with woods, and after large accumulations of moffes had vegetated. There is every reafon to believe that peat-mofs and wood are the chief materials from which coal was formed. Wood, and what has the appearance of compreffed mofs, is often found in coal. The ftrata which cover it are ufually diffeminated with petrified

wood;

wood; and the blaes, which is only coal with too great a proportion of earth in its compofition, often contains not only numerous marine plants and fhells, but alfo various impreffions of land vegetables.

Reafons were already affigned for efteeming the blind-coal in Arran of a different formation from the bituminated coal of other places. No vegetable remains were feen in the fandftone which covers it, or in any fandftone of Arran. Whether they exift in the bituminated blaes connected with the coal, or in thofe which crop out along the coaft, could only be afcertained by digging into them, which time would not permit.

IV. *On* Ironstone. Potters' Clay.

The hæmatites and kidney ironftone were probably formed at the fame time with the ftrata of red clay fchiftus and fhiver, in which they are diffeminated, and the ftrata of red fandftone in which they are enclofed.

Thefe materials feem utterly inexhauftible, and they are fituated directly oppofite to the fpacious harbour now conftructing at Ardroffan, on the coaft of Ayrfhire. When this harbour is connected with Paifley and Glafgow by a canal, an extenfive iron-work will probably be eftablifhed fome-

where

where near Dalry, which will command the carbonated ironſtone that abounds in the whole tract of the canal, and have eaſy acceſs to the ſtores in Arran, in order to produce a favourable mixture of ſtones of different qualities.

The two ſtreams of North and South Sannox may eaſily be converted into one, and produce waterfals of great altitude and power. At Sannox, Currie, and many places along the coaſt of Arran, natural wood abounds; and, were it properly managed, it might yield abundance of charcoal for making bar-iron and ſteel.

Strata of white indurated clay were ſtated to abound along the north-eaſt coaſt of Arran. I tried a ſpecimen, which was very far from being the beſt, but was within reach of conveyance. Though I had no means of pulverizing and managing it properly, it baked into ſtone of a white colour.

Even the red clays near the Cock ſeem capable of making uſeful and ornamental ſtone ware.

V. On Pitchstone.

It is hardly neceſſary to add any thing to what was ſaid of this foſſil, as it occurred during the ſurvey. It is found only in the granite mountains, or in the ſtrata of red ſandſtone. In the firſt ſituation,

ation, it always forms veins; in the laſt, it generally forms ſtrata, though it ſometimes alſo forms veins.

The body of this ſtone is the ſame with quartz, or ſilicious ſpar; and ſpecimens of it were deſcribed, ſouth from Clachland Point, which exhibited conſiderable round ſpots of quartz, of a pure white colour, amidſt the uſual dark green colour of the pitchſtone.

The experiments of my ingenious friend Dr Thomſon, already referred to, ſeem to prove, that pitchſtone owes its colour to oxyd of iron in a particular ſtate; or that ſtate of iron which conveys its peculiar colour to bottle-glaſs.

On the mountains ſouth from Muirkirk, which are moſtly compoſed of amygdaloid and red ſandſtone, I found fragments of pitchſtone; but the rocks being moſtly covered with ſoil, it was not ſeen *in ſitu*. This is only mentioned to ſhew that there is ſome apparent connexion between this foſſil and red ſandſtone.

VI. *On* Basalt, Porphyry, &c.

These I take to be the lateſt formed rocks in Arran; but as this may be deemed a hardy aſſertion by ſome, it may be neceſſary to enter more minutely into the reaſons on which it is founded.

Thoſe

Thoſe ranges of baſaltic columns, which I have called columnar ſtrata, which were ſeen to reſt upon ſtrata of ſandſtone, muſt have been depoſited after the ſandſtone ſtrata were formed; and the ſtrata of baſalt, which are interpoſed between ſtrata of ſandſtone and clay ſhiver, point out a gradual progreſs both in the depoſition and conſolidation of theſe ſtrata. They convince me, that the conſolidation of the ſtrata was not effected at once, by the ſudden action of heat; but as they were gradually depoſited, one after another, they were conſolidated in the ſame order.

The igneous theoriſts inſiſt that the baſaltic ſtrata were forced up through the veins, in a liquid form, and afterwards ſpread upon the ſurface, where, by ſlow cooling, they cryſtallized into columns; and that the baſaltic ſtrata, which are interpoſed between other ſtrata, had been injected into them from the ſame veins.

I can underſtand a liquid to be injected into cracks, or vacuities of a ſolid body; but that it ſhould be ſpread into a ſtratum, of ſuch regularity and extent as many of theſe ſtrata in Arran, appears to me utterly impoſſible. For example, the regular baſaltic ſtratum which forms the caſcade of Eſcoom, never could have been projected into its preſent poſition, againſt the preſſure of an incumbent maſs of ſtrata, of ſeveral hundred feet perpendicular. By ſuch means, a blotch, or irregular

gular mafs, might have been formed; but not a regular horizontal ftratum, of equal thicknefs, through a great extent.

Unfortunately, too, the veins which afcend to this ftratum, and the one at Effiemore, are of an entirely different character from the bafalt which covers their mouths. They are a fort of bafaltic breccia, confifting of hard, angular, or rounded fragments, immerfed in a foft matter; while the bafaltic ftrata are hard and uniform in their ftructure. Such veins could not have been raifed, in a liquid form, from the bowels of the earth, or they would have been equally homogeneous in their ftructure with the bafaltic ftrata. Thefe veins feem therefore to have been rents in the ftrata, which had been filled with fragments and mud, wafhed in from the furface, before the bafaltic ftrata were depofited above them. After the formation of thefe ftrata, other ftrata of clay and fandftone have been formed above them; and, laftly, thofe columnar ranges which occupy the fummits of thefe mountains. That thefe ranges were formed by depofition, feems very probable; becaufe no veins were feen to extend to them. The veins all terminated at the lower bafaltic ftratum, which, at Efcoom, is feveral hundred feet below their bafe.

But the rounded fragments of granite, fandftone, &c. found in the veins below Dunfiour, demonftrate,

demonſtrate, that the baſalt in theſe veins was not ejected, in a liquid form, from the bowels of the earth. We cannot ſuppoſe rounded ſtones to exiſt in the bowels of the earth, unleſs there be ſeas and rivers there to round them by attrition. The rounded maſſes of blue baſalt, and the nodules of pitchſtone, &c. often found in veins of grey baſalt, alſo prove that theſe had never been ſubjected to igneous fuſion, unleſs we can ſuppoſe this heat to be influenced by mathematical rules, and to ſpare one body, while it melts another of equal or leſs fuſibility.

In other caſes, the veins are ſeen to interſect the ſtrata, and the baſalt which reſts upon them, to their ſummits. But theſe veins are never ſeen to communicate, or mix with the baſalt; which muſt have happened, had the latter been ejected from the former; but the baſalt in the veins is invariably of a different colour and texture from that in the ſtrata.

At the Struey rocks, one baſaltic vein deciſively terminates before it reaches the bottom of the rock; and near King's Cove, veins of pitchſtone are ſeen to terminate at a much ſmaller depth. In Clachlan Burn, ſimilar veins are ſeen to terminate at no great depth, being intercepted by indurated clay. It is evident, therefore, that the matter of theſe veins had not been ejected from below, but had been waſhed in from above. But it

is

is needless to recapitulate all the facts already stated, as the conclusions that seem to result from them are generally pointed out as they occur.

By way of illustration, it may be proper to travel a little out of the record, and to adduce a fact or two from the opposite extremity of Scotland.

Caithness, and the South Isles of Orkney, are chiefly composed of red, white, and a greyish-blue calcareous sandstone. No basalt of any kind is seen, and the veins are filled with calcareous spar, or with angular fragments of the stratified rock, which are generally, though not always, cemented by spar, and sometimes with ponderous spar. At Gerstone, a little way above the bridge of Halkirk in Caithness, there is a broad vein intersecting blue calcareous sandstone and limestone. It is filled with oval and globular pebbles, which are mostly of the same species with the strata which the vein intersects; though others are granite, syenite, quartz, and other *stones*; of which there are no rocks nearer than about fifteen miles. These are all cemented together by means of spar of lime, crystallized in the vacuities. Will any man be hardy enough to assert, that these rounded pebbles were thrown up from the central region of the earth, by the expansive force of heat; and that the spar which binds them was fused, while stones of much greater fusibility than this spar, escaped fusion? Or who will assert that the sandstone veins,

veins, which often interfect the fandftone ftrata in Arran, were ejected in this manner? or that the fragments of flate, which occupy a vein in North Sannox water, and other places in Arran, were thrown up in this manner? The affertion carries abfurdity on the face of it. Such veins could not have been filled but by materials wafhed in from the furface; and I apprehend, that what is predicable of one vein, may be fafely predicated of the whole,—that they all received their materials from the furface.

This opinion is not the refult of any prejudice againft the igneous theory, or its admirers; for at one time I was as zealous a believer in this theory as even the moft fiery of our philofophers. Though a more attentive examination of geological phenomena had gradually cooled me down, I ftill continued to regard bafalt as an undoubted product of heat. But in the Shiant Ifles, fituated in the Minch, between Skye and Lewis, there is an ifland called *Garbbe* (rugged) compofed of very lofty bafaltic columns, moftly of five fides. In a fort of bay, on the north-weft fide of this ifland, the columns contain very numerous madrepores and mufcle-fhells, of an uncommon fize, and perfect form. The fhells are not even broken; and the mufcles, fo far from being injured by the heat which is fuppofed to have melted the bafalt, retain the blue colour, on their external fur-

faces, as freſh as if they had but lately been taken from the ſea. Theſe iſlands, and the neighbouring ſeas, alſo exhibit maſſy towers, and colonnades of columns, regularly articulated, and every way as perfect as thoſe of Staffa, or the Giant's Cauſeway. Whether the latter alſo contain ſhells, I had no opportunity of examining. Theſe facts convinced me that baſalt had originally been a muddy depoſite, which conſolidated and ſplit into columns, by ſlow drying, and not by ſlow cooling.

But I am far from denying the action of heat, where its effects are viſible. In Skye there are very extenſive rocks, of a ſort of coarſe breccia, including many fragments of wood, where the ſtones are partially vitrified; and the ſand, which fills up their interſtices, is cemented by means of a vitreous matter injected among it.

Sir Iſaac Newton lays down an excellent rule of philoſophizing,—that no more cauſes ſhould be admitted than what are true, and are ſufficient to account for the phenomena. So far is this central heat from being proved to exiſt, that the moſt authentic experiments demonſtrate, that the deeper we deſcend into the earth, *the more its heat diminiſhes*. But granting the exiſtence of this heat, which is merely a gratuitous ſuppoſition, it will not account for the facts I have attempted to deſcribe. I have ſtated nothing but what I ſaw; and

and the phenomena are as open to every one's obſervation as to mine.

If theſe geological phenomena cannot be accounted for by the igneous theory, but rather ſtand in direct oppoſition to that theory, the queſtion again recurs,—In what way may they be accounted for?

It is ſufficient to ſhew that they could not be produced in the way aſſigned, though we may not be able to condeſcend upon a conſiſtent mode by which they were effected.

We know that volcanoes exiſt; and though their effects are admitted to be very partial, yet they were probably much more numerous in ancient, than in modern times. Unqueſtionable traces of their effects have been pointed out in the iſland of Skye; and it is probable that the pabulum of volcanoes is, in numerous caſes, wholly exhauſted, and, in thoſe which ſtill exiſt, very much diminiſhed.

We know that earthquakes ſtill exiſt, and continue to operate very ſtriking effects upon the ſtrata of the earth. Though we do not know the cauſe which produces theſe alarming concuſſions, it is very probable that the cauſe was endowed with much more energy during the infant ſtate of the world, than at preſent.

It appears more rational to aſcribe the elevation and diſlocation of the ſtrata to cauſes which we

know to have a real exiſtence, than to a cauſe whoſe exiſtence is merely hypothetical, and whoſe operation is flatly contradicted by the phenomena.

The ſlighteſt inſpection of the material ſyſtem forcibly impreſſes on the mind, a belief, that the whole originated from a Being, intelligent and beneficent. Whether the Firſt Cauſe willed matter to obey certain laws, and left all its ſubſequent motions and combinations to be effected by the operation of theſe laws; or whether every motion and combination of matter be the reſult of his conſtant and immediate energy, it becomes not us to inquire; nor is the ſolution of this queſtion of any importance.

However unfaſhionable, and even unphiloſophical, it may appear to have recourſe to the Bible, for any aſſiſtance in geological inquiries, I cannot help flattering myſelf that the account which Moſes gives of the conſtruction of our globe, is, with one poſtulatum, more conſiſtent with phenomena, than any other that has yet been advanced.

The poſtulatum is, that what he calls days, are not meant to ſignify days according to our acceptation of the word, but periods, of a very long, but uncertain duration. This opinion has been maintained by Divines of the higheſt eminence; and even thoſe who underſtand the word in its common acceptation, muſt allow, on their own

principles,

principles, that the conſtruction of the world, or bringing it into the ſtate in which we now ſee it, was not inſtantaneous, but progreſſive.

The firſt chapter of Geneſis begins with a general aſſertion, that the material ſyſtem, or the 'heaven and the earth,' derived its exiſtence from God.

What follows is merely a detail of the different changes and arrangements that took place in the matter of which our globe is compoſed, as they would have appeared to a ſpectator placed on the earth's ſurface, after it aſſumed a ſurface on which a ſpectator could reſt.

The firſt ſtate is that of chaos,—'the earth was 'without form and void.'—This expreſſion would lead us to conclude, that the matter of which our globe is compoſed, even that which now conſtitutes the moſt ſolid rocks, was originally in a ſtate of gas, or elaſtic fluid. Independent of any thing that Moſes has ſaid, there are ſtrong reaſons for adopting this opinion, which further improvements in chemiſtry are likely to confirm. Though the formation of ſolid bodies, by gaſeous combinations, cannot be ſo frequent now as in the infant ſtate of the world, when moſt of its materials were probably gaſes, we ſeem ſtill to have an exemplification of this proceſs in the formation of meteoric ſtones.

How

How long this period continued, we cannot determine: but it appears that, in its progreſs, a great body of water was formed, perhaps by the combination of hydrogen and oxygen, and that this formed the moſt denſe part of the earth, from its centre upwards. From the combinations and precipitations going on in the maſs of vapours which ſurrounded the aqueous fluid, they ſeem to have been impervious to light. Theſe vapours were alſo agitated by a mighty wind, which would produce a colliſion among the particles, and favour their combinations. It is alſo probable that, long before the termination of this period, the aqueous maſs would be amply ſtored with earthy particles; and that even great depoſitions of theſe would have taken place, forming a denſe nucleus, of ſtratified matter, around the earth's centre.

The ſecond period is when the maſs of vapours were ſo far depurated, that the rays of light could penetrate, exhibiting a ſort of twilight; ſo that a ſpectator, on the aqueous ſurface of the earth, would imagine that light then began to exiſt. In the progreſs of this period, a limpid expanſe of air is ſeparated from the general maſs, called the firmament, having the aqueous ſurface of the earth below, and cloudy vapours in the higher regions. It is probable the other proceſſes were ſtill going on, and that large accumulations of earthy depoſite continued to be ſeparated from the aqueous fluid.

The

The third period is that in which the elevation of the ftrata took place, and the dry land was formed. I have already hinted the probability of this being produced by fome fuch caufes as now occafion earthquakes. Thefe feem to derive their origin from chemical proceffes in the bowels of the earth, which let loofe immenfe quantities of elaftic fluids, having their elafticity, perhaps, fuddenly increafed by the fhifting of the electric fluid. Thefe caufes would operate much more powerfully in the infant ftate of the world, when matter was only in a progrefs towards forming permanent combinations; and when the ftrata which refifted the efcape of thefe vapours, had not attained their prefent hardnefs and folidity: while the waters would fink into the receffes left by the upthrown ftrata.

The clofe of this period is diftinguifhed by the production of grafs, and the various tribes of plants.

In the fourth period, the atmofphere was fo far purged from aqueous, and other vapours, that not only an intercepted light could penetrate to the earth's furface, but the direct rays of the fun, moon and ftars, could reach it; fo that a fpectator on the earth's furface, would imagine that thefe luminaries then began to exift.

The fifth period is diftinguifhed by the formation of fifhes and fowls; and then, alfo, we may

fuppofe

ſuppoſe that thoſe ſtrata which exhibit the exuviæ of plants and of marine animals, were formed.

In the ſixth period quadrupeds, and terreſtrial animals were formed; and, towards its cloſe, man, to exerciſe dominion over them.

This I take to be the ſubſtance of the doctrine of Moſes concerning the coſmogony, or formation of the earth: and it is all one whether we ſuppoſe the Supreme Being impreſſed certain laws of attraction and gravitation upon matter, and left it to paſs through its ſeveral changes, in obedience to theſe laws; or that each ſucceſſive change was effected by a repetition of his volition. Moſes repreſents him as interpoſing at each ſucceſſive change; and new acts of his volition ſeem abſolutely neceſſary when plants and living creatures were formed. But in the preceding caſes no more ſeems neceſſary, than a continuation of his original volition. Indeed, I cannot conceive the laws of nature, or the mode by which matter operates on matter, to be any thing elſe but the will of God, who, had it been conſiſtent with his wiſdom and goodneſs, might have cauſed matter to obey laws very different from thoſe by which it is now regulated.

How long theſe periods, or days of creation, continued, we have no means of determining. They were ſteps in the operations of a Being, whoſe works, ſo far as we have opportunity of contemplating them, are progreſſive; and with whom

whom a thoufand years are as one day, and one day as a thoufand years. But it is probable the primary ftrata underwent feveral fucceffive revolutions of decompofition, and recompofition, before the exiftence of plants or animals; and that the fecondary ftrata, which contain impreffions and exuviæ of thefe, alfo underwent feveral revolutions.

Indications have been pointed at, which feem to fhew that certain rocks preceded granite, though granite feems to have preceded organized bodies: and the facts defcribed, refpecting breccia, feem to indicate, that the fandftone ftrata had, in fome cafes at leaft, undergone three revolutions.

It was an opinion of the late Dr Walker, that the whole clafs of inflammables, derived their peculiar properties from the action of the fun's rays. It is now generally underftood that coal, and other inflammable foffils, have been formed from vegetable and animal matters. Volcanoes are fuppofed to be caufed by pyrites, water, and coal. Hence the ftrata from which they erupt muft have been formed long after the exiftence of vegetables and animals. I am hence inclined to think there were no volcanoes in the primeval world; though there might be numerous and violent concuffions, fimilar in kind, though much more extenfive in effect, than modern earthquakes.

The late worthy Mr David Ure, in his hiſtory of Kilbride and Rutherglen, and others, have brought to light many curious facts reſpecting the remains of animals and vegetables found in the ſecondary ſtrata of the earth. Among other diſcoveries, they found plants, and animal remains, which no where exiſt, in a living ſtate, except between the tropics. Does not this ſeem to indicate, that the poles of the earth were once in the equator?—or that the earth may have a very ſlow motion from north to ſouth, as well as a rapid motion from weſt to eaſt?

One remarkable circumſtance deſerves attention,—that no bones of quadrupeds, or of men, have yet been found in the ſolid ſtrata of the earth. This ſhews they are of late origin, and will bring down their creation to the period ſpecified in the ſacred writings.

It is not long, indeed, ſince a contrary opinion was current among our philoſophers; and the bones in the rock of Gibraltar, along the ſhores of the Adriatic, and in many rocky iſlands in the Mediterranean, were alleged, even by ſkilful anatomiſts, to have moſtly belonged to the human ſpecies. Theſe rocks were repreſented as having formerly been the cemeteries of the human kind. A worthy nobleman, who pretended to no ſkill in anatomy, ſuggeſted a very pertinent queſtion on that occaſion,—whether any of the peculiar bones of

of the human head, which diftinguifh the human from other fkeletons, were to be found among this immenfe mafs of bones? On reconfideration, though many bones of the heads of other animals, fuch as jaws, teeth, fkulls, &c. were found, not one that diftinguifhes the human fpecies could be feen. It was all one;—fome philofophers had pronounced thefe to be human bones, and the people to whom the bones belonged might have contrived to live without heads, or might have depofited their heads in fome fituation apart from their other bones. It feems now to be agreed on all hands, that thefe bones did not even belong to terreftrial animals; but were the exclufive property of thofe inhabiting the fea.

Since man and quadrupeds, therefore, began to inhabit the earth, it does not appear that any very extenfive formation of new ftrata has taken place; though partial formations are often feen, by the concretion of cementing matter among the interftices of fand and gravel. Of this we have fome ftriking examples on the banks of the Tweed below Melrofe, and many other places. The principal changes have been the wearing down of the mountains by ftreams of water, and the extenfion of vallies from their *debris*. The fea feems alfo to have encroached in feveral places, and to have thrown up fand-banks, which are gradually clothed with foil, in others. There is alfo reafon to be-

lieve, that the ſea has cut through the ſofter parts of the ſtrata, in many places, ſo as to ſeparate lands that were formerly united. Of this we have an example in the disjunction of this iſland from the Continent by the Straits of Dover; and a ſtill more ſtriking example in the ſeparation of the Orkney iſlands from Caithneſs, and of theſe iſlands from each other. But in this laſt period, the greateſt changes in the ſuperficial ſtrata ſeem to have been produced by volcanoes. The original elevation of the ſtrata was aſcribed to ſome ſuch cauſes as now produce earthquakes; and the changes effected by volcanoes, are not, like the former, univerſal; but local and partial.

The view I have here given of my ideas, or rather thoſe of *Moſes*, concerning the formation or arrangement of the ſtrata of the earth, is not, I flatter myſelf, contradicted by any known fact in geology. But I admit that we are yet children in our knowledge of this ſubject; and that a ſufficient number of facts are not collected, to enable us to form a rational or conſiſtent theory,

AGRICULTURE.

In this island we behold the first rude efforts of man towards the cultivation of the earth. It will not, therefore, be necessary to enter very minutely into this branch of the subject; and it may be sufficient to describe the modes now adopted, with the changes that are necessary, in order to promote improvement.

Arable Surface.

This bears a very small proportion to the extent of the island, which being mostly occupied by lofty mountains, does not exhibit a great proportion capable of aration. But the extent actually cultivated is very small, when compared with the extent which might be profitably subjected to the plough.

The late Mr Burrel estimated the cultivated land of Arran, on the Duke's property, at 10,067 acres, and within the head dikes 15,770 acres of pasture land, mostly capable of cultivation. I am inclined to think his estimate, in both cases, but especially in the latter, very far short of the actual extent.

The valued rent, in the county books, is 5,048l. 17s. 8d. Scots; and the grofs rent of the ifland, at prefent, is 5,500l. Sterling. The net rent, after defraying public burdens, is rather under 5,000l. *per annum.* Suppofing the other properties to contain 300 arable acres; thefe, added to thofe belonging to the Duke, will make 10,367 cultivated acres in the whole ifland, and the rent of each acre very little more than ten fhillings. Thus, the immenfe extent of hill and mountain pafture may be confidered as yielding nothing to the proprietors; while the arable land, which we have faid is calculated confiderably within its extent, hardly yields them more than ten fhillings *per* acre.

Small as this rent is for fuch an extenfive ifland, it is believed that part of it is extracted from other fources than the produce of the land; and that, according to the prefent fyftem of management, the people could not bear an additional rife. This will be more eafily underftood, when we come to explain the particulars. But were this ifland only put into a tolerable train of improvement, the rent might be raifed to fifteen or twenty thoufand pounds *per annum*, or even more; and the people ftill be enabled to enjoy the comforts of wealth and independence.

STATE OF PROPERTY.

THIS iſland was originally a royal domain. It was then moſtly clothed with wood; and being ſtocked by red deer, roes, wild boars, and other animals of chaſe, was much reſorted to by our Kings, for the purpoſes of hunting. The firſt creation of private property upon it, ſeems to have been in favour of a ſmall nunnery eſtabliſhed on the iſland of Lamlaſh, which had the iſland, and ſome lands around the bay, annexed for its ſupport. The monaſtery of Kilwinning afterwards obtained a grant of the lands between Currie and Loch Ranſa; and the convent of Saddle in Kintyre, enjoyed thoſe of Schiſkin, and others, on the weſt ſide of the iſland. At the diſſolution of monaſteries, theſe lands accrued to the family of Hamilton as chieftains of the iſland.

At preſent, the Duke poſſeſſes by far the greateſt proportion of the iſland. The Marquis of Bute has three farms, thoſe of Eaſt and Weſt Corry-gills, and Kildonan. The executors of the late Duke have nine farms, moſtly intermixed with the farms which are entailed upon the dukedom. The family of Fullarton have two farms, thoſe of Glencloy and Whitefarlan, which are the beſt managed in the iſland. This may be partly owing to the waſte land having been divided, ſo that the

tenants can venture to deviate from the ufual fyftem of the ifland. This family is defcended from one MacLewis, of French extraction, who obtained a charter of their lands from Robert Bruce, dated Arnele, Nov. 26. in the fecond year of his reign, from gratitude for the fervices MacLewis afforded the King while he fkulked in Arran. Several others obtained grants of land for fervices rendered to Bruce in Arran; but their properties are now abforbed by the family of Hamilton. The lands belonging to the Duke are all entailed; but with no limitation in the power of granting leafes fhort of a hundred years; which is the longeft leafe admiffible by the law of Scotland. It has long been the practice on this property, to grant leafes for nineteen years; which would anfwer very well, were the arrangements to be fuggefted, adopted. The other properties are unentailed.

The firft and moft obvious defect in the ftate of property, is, the mountains and wafte lands being common to each proprietor, with the exception of Captain Fullarton, fo that each has an unlimited right of killing game, and of putting live ftock upon the wafte lands, independent of the extent of his property. Unlefs the wafte lands be divided, and each proprietor or his tenants be compelled to keep his live ftock within his own territories, improvement is impoffible.

But

But the evils which result from this mixed species of property, are nothing, when compared with those which result from the confused mode by which the land is possessed by the tenants.

Mode of Occupancy.

The cultivated land is occupied in run-rig, or in narrow stripes, called butts, with intervals betwixt them, whose possessors are changed every second or third year. Each farm constitutes a *societas arandi*, or township, where a number of families, sometimes to the extent of from fifteen to twenty, are concerned in its cultivation, who divide the different ridges or butts among them, either according to old usage, or according to certain regulations agreed on among themselves; and if there be a butt or ridge remaining after the division, it is subdivided by marks of stone, or sticks, into parcels corresponding to the interest each family has in the whole farm. A ridge, or patch, is frequently seen with fifteen to twenty divisions of this sort marked upon it. All are jointly and severally liable for the rent; and it is easy to see, that this mode of division, and the proportion of rent which each ought to pay, must give rise to frequent disputes.

Between the arable land and the riſe of the hills, there is a greater or leſſer extent of waſte land allotted to each farm, on which the milk cows of all the ſeveral tenants, who occupy the farm, are paſtured under the inſpection of a common herd. This appropriated tract of paſture is ſeparated from the common waſte, by a ruinous fence of turf, called the head-dike.

All the reſt of the iſland, beyond the head-dikes, is common; and when the crop is removed, the whole iſland is common to all the live ſtock upon it.

The mountains, and common paſture of the iſland, are ſtocked, or rather overſtocked, by the yeld cows, by ſheep and horſes, which all paſture promiſcuouſly, without any inſpection or care of a ſhepherd. Every one endeavours to drive his animals as far as he can from his own corn; and if they ſhould commit attacks upon that of his neighbours, he leaves them to take care of themſelves. As every one has an unlimited right of putting as many ſheep, or cattle, upon the mountains as he pleaſes, every one endeavours to put as many there as his capital or credit may enable him to procure; and there are frequent examples of perſons who pay only a few ſhillings of rent, having more numerous flocks upon the mountains, than others who pay above 40l. The conſequence is what might be expected. The graſs of theſe mountains

is torn up even by the roots. You never see a cow, or a sheep, lye down to ruminate. They are perpetually active, and seem to hold a very unequal contest with starvation. The poor animals barely exist during summer. In winter many die; and the season is commonly far advanced before the survivors are able to travel in quest of food.

It is evident, that with this mixed and confused mode of occupancy, there can be no draining, no enclosing, no sown grasses, or green crops. Let a man have ever so much capital or skill, they would be of no avail to him,—because it would be madness in him to deviate from the common routine; and if a man, by great economy, should save a little money from his farm, he has no inducement to lay it out in the melioration of the land, but must put it out to interest, or vest it in some mercantile speculation. Hence this system has an irresistible tendency to drive the capital from the land on which it was produced; while every enlightened landlord, and sound statesman, should unite in promoting the tendency of capital towards the improvement of land.

The first and most obvious step towards improvement, therefore, is not only the division of the waste land among the several proprietors, but also the judicious allotment of the cultivateable land into separate farms, of extent suited to the capital and skill of each occupant. Without this, the

iſland muſt remain for ever in its preſent unproductive ſtate, and improvement will continue to be impracticable.

FARM-OFFICES.

THESE are commonly arranged in ſmall irregular villages, generally near the extremity of the farm, where it would ſeem cultivation had firſt commenced. There is generally a large extent of paſture ground contiguous to them, called a loaning, where the cattle are collected, and by which they are conducted beyond the corn-fields. The houſes are built by the farmers themſelves, of ſtone, and wrought clay in place of cement. They have cupples built in the walls, with croſs ſpars, over which is laid bruſhwood, or cabres, to ſupport the roof. They are ſometimes thatched with ſtraw; but more frequently with heather; and the roof has a net-work of heather ropes thrown over it, on which ſtones are ſuſpended at the eaves, to prevent it from being blown away by the wind. The dwellinghouſe always conſiſts of two apartments. The larger, or kitchen, has a ſkreen of wrought clay and ſtraw, ſupported upon upright poles, between the outer-door and the fire-place, and an inner-door to exclude the cold air. The fuel is commonly peats; and the fire-place is compoſed of flat ſtones

ftones funk in the floor near the end of the houfe; but fo fituated that people can go all round. The fmoke efcapes by an aperture in the roof, which has an elevation like a bee-hive, lined with clay, to caufe a draught. A chain, attached to a crofs beam, ferves the purpofe of fufpending pots, and other utenfils; while an inftrument, called a fwey, raifes and fets down larger boilers.

The interior chamber is fometimes divided from the kitchen, by means of wooden beds, between which there is a paffage, and a door of feparation. Sometimes it is divided by a clay fkreen, which is whitewafhed on the infide. In this the fire-place is commonly placed, on a flat ftone, between jambs, and the fmoke is conducted through a chimney built in the wall. In many cafes the chamber is paved with flag-ftones; in others it has attained the luxury of a deal floor, and is covered with a deal floor above, while the walls are plaftered, or whitewafhed. The kitchen has always one window, commonly of fquare boards, fet in a frame, and rarely of glafs panes. The chamber has generally, though not always, a glafs window, of larger fize than that in the kitchen; becaufe here, no light is admitted except through the window.

I nowhere faw in Arran an abfurdity which is frequent in many parts of the Highlands, viz. the cows lodged in the fame apartment with the people. But it often happens that the cow-houfe is entered

entered by a door from behind the hallan, or ſkreen between the fire-place and outer-door; though the animals never paſs this way, having another door by which they come in, and go out of, their apartment.

The other offices are a ſtable, where the horſes are commonly driven in promiſcuouſly, and frequently ſtand to the knees in mire; a ſmall barn, in which a little rick of corn may be ſtowed and thraſhed; a ſhed for holding carts, cars, and other implements; and ſometimes a ſhed for holding peats. Every farm has at leaſt one kiln upon it; becauſe, here, the corn is not dried at the mill where it is ground, but at the farm where it is produced. Theſe kilns are generally of very awkward conſtruction; ſometimes not covered from the rain except by blankets ſupported on poles. The corn is laid upon ſtraw, ſpread upon croſs poles ſituated a little below the mouth of the inverted cone, which is the figure of the kiln. The fuel is a fire of peats, or bruſhwood, in the mouth of a ſmall aperture which conducts into the bottom of the kiln. Often the flame ſets fire to the ſtraw, and corn incumbent on it; and it always happens that the corn is irregularly dried, and a quantity of it eſcapes through the ſtraw, and is loſt.

Each tenant in the ſociety has a ſuite of theſe buildings, though the kiln is often common to the village.

village. They are all conſtructed and repaired by the people themſelves; which occupies much valuable time during ſummer; and they are arranged without order or ſymmetry.

Were the land divided into ſeparate farms, it would be proper to have commodious farm-offices built in the centre of each farm. The iſland abounds in ſlates, and clays adapted for making excellent tiles. Theſe, in the end, would be found the cheapeſt of all roofs; and their uſe would ſuperſede the neceſſity of deſtroying much valuable land, by cutting turf for covering houſes, or faſtening the thatch.

IMPLEMENTS OF HUSBANDRY.

THESE are moſtly made and repaired by the farmers themſelves; and the improvident deſtruction of the woods which formerly abounded in this iſland, is now the ſource of great hardſhips to the people. In order to get a few ſticks for a plough, or a car, &c. four men muſt ſet off in a boat to Ayr or Argyleſhire, when they hear that woods are cutting. There they are often detained a whole fortnight, and expend much more than the value of their ſticks, beſide their loſs of time.

Their implements are,

1. A very awkward and clumſy Scotch plough, of the old conſtruction, drawn by four horſes, yoked two and two, with a driver. Generally a man or two follows the plough, to reduce inequalities by the ſpade. I did not ſee the *caiscrom*, or ploughing ſpade, which ſtill continues in many parts of the Highlands, in any part of Arran.

2. A light harrow, of three bills, and ſhort iron teeth, drawn, in pairs, by a horſe to each. Theſe harrows require to go very often over the ground before they cover the ſeed; ſo that where the land is ſtiff, or cloddy, which frequently happens, harrowing is a much more tedious operation than ploughing. They only ſcratch the ſurface; never penetrating the land ſo as to tear up the root-weeds.

3. Iron ſpades of the uſual conſtruction. They have alſo a wooden ſpade, which is peculiar to the Highlands. It is an angular piece of wood, ſhod with three or four inches of iron at its point, and having a long handle on its right ſide, dreſſed from the ſame piece of wood. The angle projected from the handle, towards the left, ſerves for preſſing it down with the foot. For digging in ſtony ground, and other kinds of work, this ſpade anſwers better than thoſe in general uſe. The people uſe it, in place of a hand-hoe, for planting, cleaning, and digging their potatoes.

They

They alſo frequently uſe it for cutting peats; though they have a much longer and narrower ſpade, of the ſame conſtruction, for that purpoſe.

4. Cars, or ſledges. Theſe conſiſt of two beams, or trams, joined together by croſs-bars, or rungs. The horſe is yoked into them the ſame way as into a cart; and the only difference is, that the cars want wheels, but ſlide upon the ground at the hind end of the trams. They are uſed for carrying out dung, which is put in creels or baſkets, faſtened to the cars; or for bringing home peats and corn; in which caſes, the cars are commonly furniſhed with a back of ſticks.

At South-End, and other places where there is level ground, or the ſlighteſt mockery of roads, the people uſe ſmall carts, of very elegant conſtruction, which they import from Ayrſhire; a proof that they are willing to adopt the moſt approved practices, were they put into a ſituation to render it poſſible.

All carriages, except through the farm, or to boats in its vicinity, are performed on horſes' backs; becauſe there are interruptions between one diſtrict of the iſland and another, which are not ſurmountable even by cars.

It is not intended to enter into a detail of all the implements uſed in this iſland, but only to point out ſuch as are peculiar to this, and other parts

parts of the Highlands. None of the improved implements, and few of the improved practices, of other places, have yet reached this iſland.

Live Stock. Horses.

The original breed was very ſmall; becauſe, if a mare got a foal in the moors, ſhe was allowed to rear it there, without aſſiſtance. Of late, breeding has much declined; and horſes of a larger ſize are imported from Argyleſhire, ſometimes to croſs with the natives, but more frequently for the purpoſes of labour. The late Duke endeavoured to improve the breed of this iſland, by importing ſtallions; by horſe-races, and other premiums;—juſt as a predeceſſor of his eſtabliſhed the Lanarkſhire breed of horſes, which, for labour, is unqeſtionably the beſt breed in the world. Thoſe imported from Argyleſhire, ſeem to have ſome of the Iſle of Mull blood in them, derived from horſes reſcued from the wreck of the Spaniſh Armada. The original breed of Arran ſeems to have been derived from the ſame ſtock, and poſſeſſes all their good qualities, though under a diminutive form.

Such of theſe animals as are accuſtomed to the ſaddle, are docile and tractable in an extraordinary degree; patient of fatigue; endure hunger; and gratefully take any kind of food that is offered them.

them. Their fureness of foot is most remarkable. They will scamper with you over loose fragments of rock, and down steep declivities covered by the same. In these cases, the judgment with which they choose their steps, and lift their feet over the larger blocks, is truly astonishing. In general, the slightest pull of the bridle will turn them any way you please. But there are cases, where they know they are right, and you are wrong; and if they should choose to walk along the very edge of an unfathomable precipice, it would be very dangerous to enter into a dispute with them. The result of the dispute would be, that the animal would take the road which it knew to be safest and best for itself; and your persevering in the argument would only endanger your being both thrown over the precipice.

The average size of horses here varies from about ten to fourteen hands high. Many of them are of size and strength sufficient to draw the two-horse plough, especially in such friable soils as abound in Arran. Were the requisites to be afterwards mentioned provided, and followed by judicious crossing, a breed might be reared here for the saddle, superior to any in the world.

Cows.

Cows.

The cows here are generally of fmall fize, and do not feem capable of feeding beyond fifteen ftone. Some may feed much higher, when properly cared for in early life; which is not the cafe in general. I was told, though I cannot verify the fact, that they feldom produce calves until they are four or five years old. This may naturally be expected from the ftarving regimen to which they are fubjected from early life upwards.

They are moftly thin on the back, fmall in the fore quarter, big, and loofe bellied, and every way ill-fhaped. Their colour is either black or brown, never fpotted; which feems to be an effect of more complete domeftication. They feem to be a confufed jumble of various breeds; fome of Irifh extraction; fome from Argylefhire; fome of the Galloway race, which are hornlefs. Owing to intermixture, fome mongrels of this breed have a fmall horn, not fixed to the fkull, but attached to a cutaneous membrane on the left fide of the head; and others a fimilar, though fmaller horn, fimilarly attached to the right fide.

Though this be the general character of the animals, many individuals exhibit all the points of a well-fhaped cow, and afford a bafis on which fkill and perfeverance might rear a very valuable breed.

breed. This cannot be done by introducing bulls of a large ſize from more improved diſtricts, which the Highland Society have encouraged by their premiums.

The way to improve the breed both of horſes and cows here, is, 1ſt, Aboliſh commons, and give every man a complete command of his ſtock, within his own premiſes. 2dly, Let abundant food be provided, in winter as well as ſummer. 3dly, Select the beſt of each ſex for breeding; and when food is abundant, judicious croſſing may be tried. But croſſing with a large bull or high-blooded ſtallion, animals which are turned out to a ſteril moor, where even the heath is ate to the bare ſtumps, is an abſurdity which could only enter into the brain of a madman.

The milk-cows have been deſcribed as herded within the head dikes. They get very little food beyond what they can pick up in that ſituation. The quantity of milk they yield is very ſmall; but very rich, and well-flavoured. The quantity cannot be aſcertained; becauſe the calves, confined before, are allowed to ſuck their mothers a ſhort time previous to the milking; and often the dairy-maid milks one ſide of the udder, while the calf is ſucking the other.

The people here make very little cheeſe, except ſome from ſkimmed milk, for their own uſe. But they make excellent butter, of a bright yellow

low colour, and fine flavour; which they cure with Irish salt, in a very superior style.

SHEEP.

THESE are a small, hornless, white-faced breed, which were probably brought here by the Norwegians when they possessed the Hebrides. They feed to about four pounds per quarter; their mutton very sweet, but weak and unsubstantial. Their wool is very fine, but unequal in quality, and of small quantity. Among them are several crosses with the black-faced breed, the effect of which has been to convey a mixture of black and white to the face; with one, and sometimes two, small horns. Many of them are black, or brown, which are much esteemed; because, by scribbling their wool among the white, they make a sort of mixed cloth, without dying. Most of the wool is wrought into cloth in the island, for the use of the natives.

The hardships these animals endure are incredible; and were proper means adopted to provide them with an abundant supply of food, in winter as well as in summer, it is possible a very valuable breed might be selected from them. But while all go promiscuously; are hardly above starvation in summer, and in winter and spring are reduced

duced to the laſt extremity; improving them is utterly impracticable.

Mr Crauford of Machry is the only tenant in the iſland who has got a hill and dale farm ſeparated from the maſs of common, and free of all intermixture. He has introduced a flock of black-faced ſheep, with a ſhepherd from Argyleſhire, which ſeem to thrive remarkably well. But as he underſtocks, and keeps good graſs, he is perpetually annoyed, by all the ſheep and cattle of the iſland intruding into his premiſes. Hence a great improvement cannot be effected here, unleſs it were the reſult of a general arrangement, comprehending the whole iſland. Mr Hamilton of Glenſuig has introduced the black-faced breed under the diſadvantage of putting them upon a bare common, where they are intermixed with the other ſheep; while his arable land is run-rig, or intermixed among that of ſeveral other tenants. This ſhews the people here would adopt improvements, were thoſe ſteps taken on the part of the proprietors, which would render improvement practicable.

Each individual farmer has appropriate marks, by which he diſtinguiſhes his ſheep and other ſtock from thoſe of others. Towards the north, the ſheep are marked by hæmatites, called keel, in various parts of their bodies. In other places, by cutting their ears in various ways. In other places,

ces, by thrusting thin slips of cloth, or thread, of various colours, through the external membrane of the skin, in various parts of the body of the animal. The cows are marked by clipping figures upon their hair; or by cutting their dewlap, from the throat downwards to the breast-bone, in a particular way. The marking of horses has become less frequent, as breeding has diminished. It is commonly done by clipping a particular mark in some part of the hair; but was formerly done by clapping a red-hot horse-shoe on some part of the animal's body; which practice still continues to a certain extent.

During winter, the cows and horses are generally housed at night, though not always. The former get a little fodder, the latter seldom. In other respects, the whole live-stock has no other source of subsistence but what they can gather in the fields, and along the sea-shores. The quantity of fodder being very scanty, in proportion to the demand, the animals are reduced to mere skeletons towards spring; and, if the winter be unusually severe, many die.

GAME.

AMONG the quadrupeds which come under this description, the roes which formerly abounded, are

now

now wholly extinct. So alſo are the wild boars, though a few tame ſwine are kept by the farmers. Theſe ſwine ſeem to be derived from the ancient wild boars, and are the ſame breed which prevails through all the Highlands. They are of ſmall ſize, ſhort ears, though longer than thoſe of the Chineſe breed, thin on the back, of a yellow colour, or variegated by rounded ſpots of black, and have briſtles. As no attention has ever been paid either to their feeding, or breeding, they ought not to be raſhly condemned. Perhaps ſkill and perſeverance may elicit a valuable breed from them. When tolerably fed, they make pork of the fineſt flavour.

The red deer, which was anciently the moſt conſpicuous quadruped on the iſland, are either wholly, or nearly, extirpated. This ſeems to have been occaſioned by the improvident deſtruction of the woods, which afforded them covert and ſhelter during winter. A few are ſaid ſtill to loiter amidſt the receſſes of the granite mountains; though I did not ſee any of them, when ſcrambling through thoſe terrific regions.

Wild goats formerly abounded in Arran; and though their extirpation has been encouraged, on account of the miſchief they did to plantations, a few are ſaid ſtill to exiſt among the mountains.

Hares abound in all parts of the iſland; and

 rabbits

rabbits among heaps of ſtones, or on ſandy downs near the ſea-ſhore.

No foxes, or other quadrupeds of prey, were ever ſeen in Arran; and it is to be hoped that none of our modern Nimrods will be ſo mad as to attempt their introduction.

Among the feathered tribes, the caperkailzie formerly abounded, but ſeems now to be extirpated. The black-cock and grouſe ſwarm in the moſt unbounded profuſion; and I ſuſpect their further multiplication is prevented, by not having a ſufficient proportion annually deſtroyed. Among theſe a few quails occur. On the granite mountains, the ptarmigan has choſen his reſidence. This bird ſeems to be the moſt extraordinary of any in exiſtence. He is ſo much in love with cold, that he never deſcends from his aërial regions, even when the mountains are clothed with ſnow. During winter he is ſaid to become as white as the ſnow. But I cannot conceive the poſſibility of an animal exiſting in ſuch a ſituation, where he can get nothing but ſnow on which to feed and repoſe; and is unfurniſhed with inſtruments by which he may dig throw the ſnow, ſo as to get at the herbage below. I am rather inclined to think, (notwithſtanding numerous teſtimonies to the contrary), that he muſt creep into a chink of the rocks, and there remain torpid, until the warmth of ſpring has diſſolved the ſnows.

Among

Among the wild birds are plovers of various ſpecies; ſtarlings; and others of ſmaller ſize, which ſeem to be migratory. A few partridges are found at South-End, and this bird can only propagate as cultivation increaſes.

The birds of prey are, eagles, kites, hawks of various ſpecies, and carrion-crows. The premiums given by the late Duke, for the preſervation of game, have nearly effected their extirpation.

REPTILES.

SERPENTS abound in Arran, and are thought to have multiplied ſince the birds of prey have been nearly extirpated. A ſpecies of hawk was deſcribed to me which preferred ſerpents to every other food. His method was, to ſeize the ſerpent by the tail, and carry him high in the air, ſwinging him ſo that he could not turn to bite; and, having dropped him upon a rock or ſtone, the ſerpent was ſo much ſtunned, that the hawk could deſcend and devour him in ſafety.

The ſerpents ſometimes kill ſheep, and convey to cows and horſes, and even to men, a temporary lameneſs. The largeſt I ſaw were about three feet in length; but was told that many of them exceed four. I obſerved three ſpecies, clearly diſtinguiſhed by their colour and ſpots; but as they

are known to caſt their ſkins, the people believe them to be all of one ſpecies, at different periods of their growth.

1. The common adder, or viper. It is of a dirty green colour, with a mixture of yellow, and dull purple ſtreaks, irregularly diſpoſed. It has a forked tongue.

2. Another ſpecies had a purple ſtripe running down its back from head to tail, from which purple ſtripes, forming meeting ſegments of circles, were projected on each ſide. Theſe lateral purple ſegments included ſpots of a pale golden yellow colour, exactly ſhaped like eyes; which were large or ſmall according to the breadth of the back, and were very regular and beautiful. The belly was flat, and azure blue. Obſerved no tongue; but its fang or ſting was of a black ebony colour, inſerted within its lower jaw, and which it could turn in various directions, and protrude by muſcular power. I ſuſpect this to be a different ſpecies from the firſt, becauſe I ſaw them of various ſizes, from about ſix inches to about three feet.

3. The third ſpecies was round in the body, of a dark gloſſy blue colour, ſmooth as ſatin, both on back and belly. The back was variegated by pale blue ſtreaks reſembling poliſhed ſilver, three of which formed parallel ſegments of circles which croſſed each other at the centre of the back,

and

and met towards the belly. Obferved no tongue; but its fang was every way fimilar to that of the former. This is by far the moft beautiful of the ferpent tribes I ever obferved. Whether it be a diftinct fpecies, I fhall not pretend to decide; for I only faw one about two feet fix inches in length. Was told they often exceed four feet; but the people impute their dark blue colour to age, and not to difference of fpecies.

A diftinct fpecies of ferpent, which never attains a large fize, was faid to neftle among the loofe ftones along the fhores of Lamlafh; but I did not fee any of them.

Mr Pennant defcribes a toad of enormous fize, as a native of Arran. I was told that fuch toads exift there, though I did not fee any of them.

COURSE OF CROPPING.

HERE no rotation, or general fyftem, prevails. The different hamlets, or *focietates arandi*, have rules and regulations peculiar to each hamlet; and they often depart from, and vary their rules, by mutual compact, which is a fource of much difpute among themfelves, and not feldom of expenfive litigation. Such communities are a juft exemplification of the doctrine of liberty and equality, reduced to practice; where all are equal, it is true;

true; but it unfortunately happens, that all are equally poor. No man, be his talents and industry ever so great, can better his situation by professional improvements: and he can only hope to save a little by penurious living, and removing what he can from the farm.

The cultivated land is divided into infield and outfield. Though it is impossible to condescend on particulars, it may be useful to point out the general outline of the treatment to which these several descriptions of land are subjected, or rather condemned.

We shall begin with the outfield, because it is furthest from the village where the cultivators reside.

The treatment of the outfield land is various, as must easily occur to any one who keeps in view, that it is ploughed in lots by a community, who vary their plans according to circumstances. But it generally gets a little manure the first year it is broken up. It is then cropped with oats two years, or as long as it can double the seed; and is then left to gather grass, or rather weeds, as it can; and is rested two, or three, or more years. When manure cannot be procured, the outfield is allowed to remain untouched, until the tread, the browsing, and droppings of cattle have begun to subdue the weeds, and to coat the surface with a grassy sward.

fward. It is then maffacred as before; and no other crop but oats is ever put upon the outfield.

The infield land is always in crop, except when a deficiency of manure, and its inability to repeat the feed, compel a reft. It is of no confequence where we begin the general rotation; becaufe, as already obferved, there is, in fact, neither fyftem, nor rotation. But we fhall begin with,

1. Potatoes.—Thefe are either dibbled or planted by the hand, in ruts formed by the fpade, forming rows acrofs the ridges previoufly ploughed. At South-End, and fome other places, they have begun to plant them by the plough, which yields the largeft and beft produce. But as none of their ploughmen can draw a ftraight drill, their drills difcover ftrange inequalities. Sometimes they get fo clofe that no plough can work between them: at others, there are broad fpaces without any plants. In general, whether they plant by the hand or by the plough, the rows are too clofe to each other, and the number of feeds in each row by far too great. The effect of this too great crowd of feeds can eafily be underftood, when it is ftated, that the produce varies from fifteen to forty bolls *per* acre, as far as the eye can judge of acres, where there is no meafurement. This is a very fmall produce in a country whofe foil and climate are fo well adapted for that plant, that we might be tempted to reckon Arran the native

country

country of the potato. Here, neither ſcab, nor curl, nor worm, nor other diſeaſe which is known to infeſt the potatoes of other diſtricts, were ever heard of. The potatoes here are uncommonly farinaceous, and of fine flavour. They always get manure of ſea-weeds, or of dung, or of compoſt of dung.

Thoſe planted by the hand are cleaned by the ſpade already deſcribed; while the weeds in the rows are pulled out by the hand. When the plants are in the act of ſpringing above ground, they are generally covered with a ſprinkling of earth from the furrows. The effect of this is to ſmother the weeds a ſhort time, and to afford opportunity to the potatoe plants of getting the ſtart of them. Thoſe planted by the plough, from the awkwardneſs of the operation, generally receive more aſſiſtance from hand, than from horſe-hoeing.

In moſt caſes, a man ſhifts his lot, or ridge, every year. But when he plants potatoes, with manure, he always keeps this lot two, and ſometimes three years.

2. Oats, or Bear.—If the latter, the land gets more manure. Average produce of bear, from three to four ſeeds.

3. Maſhlam, or Oats and Peas mixed.—Produce about two ſeeds. Sometimes peas, or peas and beans mixed, without any oats.

4.

4. If dung is wanting, or sea-weeds, the land is rested two years. But if these can be applied, bear is again sown.

5. Peas are commonly sown, chiefly for the straw.

6. If the peas be tolerable, oats succeed.

7. Bear, again, with manure; or potatoes, as at first.

The bear land commonly gets one ploughing; is afterwards harrowed, and the manure spread equally over the surface. The bear is sown upon the manure, and the seed covered by fresh earth, thrown from the furrows by the spade. In this way the bear starts earlier than the weeds.

In other cases the bear land gets two ploughings. The manure is covered down at the second ploughing, and then the seed is harrowed in.

The time of sowing is from the beginning of April to the end of May. The time of reaping is from the middle of September to the end of October. The reaping is mostly performed by women, who understand that work well, and cut very close and clean. But the crop is sometimes so short, that they are obliged to pull it up by the roots; and they always pull the bands for the sheaves up by the roots. As they have no fanners, or wire sieves in the island, this occasions their bread to be much infested with earth and sand.

The

The corn is winnowed by being ſhaken before a current of air, between two oppoſite barn-doors. White oats have long ſuperſeded the grey and black oats, which ſtill prevail in moſt parts of the Highlands; and they frequently introduce a change of ſeed from Ayrſhire. But a very bad practice is too common, of reſerving what is called the tails, or lighteſt of their grain, for ſeed, while the plump, and well filled grain is converted into meal. This occaſions a much greater quantity of ſeed to be ſown, than would be otherwiſe neceſſary, together with the rapid degeneracy of the ſeed.

MILLS.

THERE are five corn-mills in Arran, all the property of the Duke, and the whole iſland is bound in thirlage to them. The mill-dues for different lands, vary from the ſixteenth to the tenth peck; and muſt be paid whether the corn be ground at them or not. This may be no great inconveniency while the iſland does not produce enough for its own conſumption; but, by impoſing a reſtraint on the commerce of corn, muſt operate as a great bar to improvement. Corn, with this tax upon it, cannot compete with corn that is free, when exported to a diſtant market. As the greateſt part of the lands aſtricted belong to the Duke himſelf,

himſelf, it would be eaſy for him to relieve his own tenants from this grievance; and leave the other proprietors to compound, or not, as they thought proper. As no more originally entered into contemplation, when theſe aſtrictions were eſtabliſhed, than the portion of grain which was conſumed by the people themſelves, it is not likely they will carry this portion from their mills, though the aſtriction were removed. Hence the mills will probably bring as high a rent after they are made free, as they do at preſent; and the tenants will have the advantage of getting their work much better executed.

The tenants are bound to repair the mill-dams, and to perform other ſervices neceſſary to keep the mill going; while the miller keeps up the machinery. The tenants perform all the work at the mill, in grinding their ſeveral parcels of corn. They winnow the ſhealing, or kernel of the grain, on blankets ſpread in the open air, at the great riſk of having it damaged by rain; and requiring an enormous expenditure of time. If fanners, with wire ſieves, or ſkreens, cannot be introduced into every farm, they ought, at leaſt, to perform this operation with more rapidity and ſafety, and to extract the particles of ſand and earth with which much of the grain of this iſland is contaminated, to be eſtabliſhed in every mill, and to be worked by the water-wheel.

Hints of Improvements.

From the defcription which has already been given of the actual ftate of agriculture in this ifland, the improvements it admits of may eafily be anticipated.

The *firft* and moft effential improvement is the abolition of common, by dividing the hills and mountains among the feveral proprietors. The *fecond* is the allotment of the arable land into feparate farms, with a portion of the improveable wafte annexed to each, and building fubftantial farm-offices in the moft commodious fituations for each farm. The tenants fhould be taken bound to bring into cultivation a certain extent of wafte land annually, by liming, or otherwife. *Third*, Enclofing and draining. In moft cafes, enclofing by hedge and ditch will ferve all the purpofes of draining. Where the land is dry, ftone walls may ferve all the purpofes of fences. In other cafes, concealed drains are neceffary, for which there are every where abundance of ftones. Inftead of the prefent ufelefs head-*dikes*, a ditch fhould be run acrofs the declivity of the hills, at as high an elevation as it is poffible ever to carry the plough. It fhould be floped above, and faced with ftone below, on the perpendicular fide, to prevent the mound from being wafhed away. In fome cafes,

it

it may be neceſſary to pave the bottom of the ditch with ſtones. This ſtone-facing ſhould be ſurmounted by a Galloway coping, ſufficient to exclude ſheep, or by ſtake and rice. The mound of earth thrown from the ditch ſhould be levelled, and be ſown with whins, or furze, in drills. This ſhrub thrives well in the iſland; and in this ſituation would ſerve the purpoſe of ſhelter and ornament, as well as of a fence. It would alſo prove an excellent reſource to ſheep when admitted within the fence during winter. Croſſing the declivity of the hills by a ditch, would alſo throw aſide the water which oozes down from above, and injures much good land lower ſituated.

The horſes and cows ſhould not be allowed to ſtray beyond the head-dikes; and even the ſpace within them ſhould be very lightly ſtocked.

Theſe things being put into a train of execution, the whole hills and mountains ſhould be lotted into ſheep-farms. This would prove a very eaſy operation, as they are divided by natural boundaries into portions of very various extent; viz. deep ravines, in which run ſtreams of water, and the ſhedding of the water at their ſummits. The cattle in the lower grounds ſhould be encloſed or herded; but, in the mountains, every flock of ſheep ſhould be under the care of a ſhepherd, and no encroachments permitted. It is needleſs

to repeat how much it behoves the mountains, as well as the vallies, to be lightly ſtocked. Grazing ground ſhould always have at leaſt a third leſs ſtock than it can eaſily maintain.

If farmers from a diſtance cannot be induced to embark in ſheep-farming on an extenſive ſcale, there are people on the iſland poſſeſſed of ſtock ſufficient for any undertaking of this ſort, were their hands unfettered, and left at liberty to act for their own and the general good. Should theſe not prove adequate to ſtock the whole mountains on a ſkilful ſyſtem of ſheep-farming, joint-ſtock ſheep farms ſhould be recurred to. This is done, by a number of ſmall tenants joining together, in order to ſtock a mountainous tract, for which the means of any individual are inadequate. Whether poſſeſſed by an individual, or by a company, ſheep thrive beſt when the extent allotted to a flock admits it to be divided into three hirſels, or flocks, each under its proper ſhepherd.

This joint-ſtock ſheep farming has already been reduced to practice by Mr Campbell, on a property in Lochaber. It was accompanied with a diviſion of the arable from run-rig, into ſeveralty; and its effects have proved highly beneficial. Inſtead of deſtroying aration or population, it has occaſioned a rapid extenſion of both. But the inconſiderate rage for ſheep-farming, which prevails among our Highland proprietors, has baniſh-

ed

ed aration and population from many extenfive tracts where they previoufly exifted. Manage fheep in fuch a way, that their introduction, as a principal object, fhall increafe cultivation in the vallies, and places capable of culture, and fheep will prove the fource of increafed population, and of profperity to the Highlands.

In the glens where clay marl abounds, and along the fea-banks and fhores, fweet graffes grow with the utmoft luxuriance. Such places fhould therefore be referved for wintering the fheep. Even the mountain paftures admit of confiderable improvement, by burning the heath; which has been too much difcouraged, from the foolifh notion of preferving the game. Where the heath is burnt on a dry bottom, ferns fpring up, with a clofe pile of fweet graffes, and white clover below.

But it frequently happens that the pafture is injured through a long declivity, by water which trickles down from the higher grounds, and foaks and renders miry thofe lower fituated. Such water fhould be intercepted by ruts drawn with the plough aflant the line of its defcent, and conducted into fome natural difcharge of water. The coarfe herbage may then be burnt; and in many cafes lime, or other manure, may be profitably fpread upon the fward, to improve the pafture. Towards the bottoms of the hills, it frequently

happens that springs erupt, and produce a sort of shaking bogs, or round miry hillocks, very dangerous both for sheep and cattle; while the water, spreading on the flat surface below, renders it miry. Such springs should be taken off by a ditch led up to the fountain-head, which is bored at certain points. There are many cases where the springs may be made to improve the herbage by watering. Were these suggestions carried into effect, the mountains would be rendered capable of sustaining not only a much more numerous flock, but would also become very healthful for sheep.

Much controversy has arisen respecting the comparative merits of the black-faced and improved Cheviots, as mountain breeds of sheep. I apprehend the controversy refers to local situation, rather than to the sheep, veiwed in the abstract. The Cheviot lambs, having no wool when they are dropped, are very delicate in infancy, and require sheltered situations, and sweet grass, during that season. But after they attain strength, and a covering of wool, they become equally hardy as the black-faced breed. Their carcase is of equal, and their wool of far greater value than that of the latter.

The question, then, as far as it relates to Arran, may be easily decided. Where there are sheltered glens, or variety of exposure, skirted by brushwood, in the lower grounds, the Cheviots

are

are likely to thrive. Where these do not occur, the black-faced should be adopted. The propriety of attempting to improve the native breed has already been hinted at.

With regard to the low lands of Arran, the soil, where it is formed from the decomposition of red sandstone and shiver, and of whinstone, is every way similar to the soils of Berwickshire. The climate is also remarkably similar, the two places being nearly on the same parallel of latitude. Perhaps there may be more rain in Arran, which is still more favourable for sown grasses and green crops.

I observed one field of turnips, which exhibited an uncommon freshness and luxuriance. They had not been thinned, or properly managed; but where they happened to be thin by accident, they had attained an uncommon size. The fly, worm, and other insects which destroy turnips in other places, are not known here.

It would therefore be proper to subject the cultivateable lands to the Berwickshire system of alternate cropping and pasture, having a green crop interposed between every two white crops. One field, which had been limed and laid down in grass, exhibited an uncommon luxuriance and closeness of pile. In most situations, it would let for five pounds per acre in pasture.

MANURES.

THESE are chiefly the dung of cattle, which they mix with turf. This practice occafions the deftruction of much valuable furface, and fills the infield land with weeds.

The clay marl, which was ftated to abound in many places, had probably been derived from the decompofition of fuch marly ftrata as were defcribed to accompany the limeftone with a greater or fmaller mixture of other earths and ftones. It would anfwer much better than turf for *making* compofts; and on loofe, fandy, gravelly, or moffy foils, would prove of great utility without any mixture of dung. Where this does not abound, they fhould make their compofts of fwampy earth, or mofs, which would anfwer for all foils except mofs.

The fmall fhell-fifhes which accumulate fhell-marl, abound in Arran; but though the fwamps were explored with great care, no accumulations of this marl, of any confequence, could be found. It appeared that the animals had been difturbed, and prevented from accumulating by mountain torrents wafhing earth and fand into the fwamps, which were formerly lakes.

During fpring, they collect drifted fea-weeds along the fhores, and apply them as manure. The

The people on th col-
lect these weeds n on
shore by a storm, mposts
with earth; a pra be ad-
opted by the peop

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Arran abound and it occurs
either in veins, or in n in veins, it is
sparry, or consists of rounded p es of chalk, im-
mersed in a chalky ground, of a greyish colour.
In one case, angular fragments of stratified lime-
stone are intermixed with the chalk. The chalky
stone, when stratified, contains a greater or small-
er proportion of rounded adventitious stones inter-
mixed. The other stratified limestone contains
sea shells; and the marly strata which alternate
with it, contain impressions of shells, and of ma-
rine plants. When this occurs in a group of red
sandstone strata, there is always a bed of white
sandstone next the limestone. The blood-red
limestone, which abounds from Currie to the
Cock, though stratified, does not exhibit any
shells. This species has not been used; and there-
fore, it did not attract particular notice. The
propriety of trying whether it would serve the pur-
pose of puzzolana, has been already suggested.

The

T made upon these stones bserved to differ in colour ... e reckoned to express the aver n limestones.

1. South Curri

Carb		98½
Clay		1½
		100

2. Rented quarry of Currie.

No. 1.	Carbonate of lime	-	90½
	Clay and some iron	-	9½
			100
No. 2.	Carbonate of lime	-	97
	Clay and some iron	-	3
			100

3. Alcraspoch limestone, head of Benlester glen, behind Lamlash.

Carbonate of lime	-	96
Iron	- - - - - - -	3
Clay	- - - - - - -	1
		100

Parts

Parts of this vein are chalky, and others sparry. The latter seems to approach absolute purity. But it contains many fragments of a reddish brown or blue limestone, which appear to have been detached from strata, on one of which the analysis was performed.

4. Glenluig chalky limestone.

Carbonate of lime -	98
Clay - - - - - -	2
	100

This may be considered as expressing the average purity of the indurated chalky rocks of Arran, in so far as they are not contaminated by a mixture of adventitious stones. The particulars relative to these intermixtures have been already pointed out.

It will hence appear, that Arran abounds with limestones of uncommon good quality. Were the Ardrossan canal completed, abundance of small coal could be procured, at a cheap rate, for burning limestone. It might then be found expedient to establish draw-kilns, of the best construction, for supplying the lands of Arran with this useful manure, and for exportation. Vessels with double bottoms, such as Lord Elgin uses, are known to carry lime by sea, to all places, with the utmost safety.

ROADS.

THE Dutchefs Ann, who feems to have been a woman of a ftrong mind, and far beyond the barbarous age in which fhe lived, firft began the making of roads in Arran; and, as far as I could learn, excepting a few repairs, they never have been carried further than fhe left them. But, unfortunately, in her time, the proper lines of roads were not underftood. In place of going round a hill, they went ftraight over its top. This may eafily be accounted for from the ideas of thofe times. Wheel carriages, and their accommodation, did not enter into their thoughts, becaufe they were hardly known. Roads on which people could ride without breaking their necks, and on which horfes could carry a heavier load than they could on rugged precipices, was all that entered into their contemplation.

It is unneceffary to enter minutely into this fubject, becaufe it cannot be underftood, except by people upon the fpot. I only beg leave to offer a few general remarks.

Arran requires a road all round her, and one from the head of Broddick Bay to Shifkin. In this extenfive tract, great part of the road is already made by nature; and the reft, in moft cafes, only requires formation. In the track round the ifland,

iſland, four difficult paſſes occur; but an obſervant eye can ſee a moſt eaſy road through them. No ſtone bridges exiſt in Arran; but a few are neceſſary; and nature has marked poſitions where a very ſmall arch can be thrown from rock to rock, ſo ſituated as moſt effectually to render the road beneficial. In a few caſes, gullies muſt be paſſed by a ſlope cut in the bank on each ſide.

In addition to theſe great lines, a few accommodation roads are neceſſary, to carry lime, or other manures, to improveable land; or to form communications between the cultivated land, and the propoſed fiſhing ſtations on the ſea-coaſt. Theſe collateral roads may be executed when their neceſſity becomes obvious.

The great lines are ſo indiſpenſably neceſſary, that Arran cannot take advantage of its ſoil; improve its fiſheries; or become the theatre of thoſe manufactures, for which I have explained her adaptation, without them.

I have ſtrongly recommended taking advantage of the generoſity, and, I may add, patriotiſm of Government: and fondly hope my recommendation will not prove fruitleſs. I hope that the good intentions of Government may produce a ſuitable cooperation on the part of our Highland chieftains; and that the Highlands and Iſles, by improving their inexhauſtible reſources, may become the right

arm

arm of the empire, ready to hurl her thunders around the globe.

Woods and Plantations.

It has been ſtated, that a great part of this iſland was anciently covered with wood; and conſiderable tracks of it are yet natural ſtools of birch, oak, aſh, aller, willow, and various ſhrubs. The ſervice tree is ſeen to rear itſelf far up the ſides of the granite mountains, regardleſs of all the ſtorms with which it is aſſailed. At Arran Caſtle, and other places, there are a few plantations which thrive remarkably well. Here none of the diſeaſes, or paraſytical plants, or inſects, which injure trees in other places, are known. Their bark is always clean and healthy; their ſhoots vigorous.

It would be proper to encloſe and plant the vacancies in the natural woods. Were the numerous ravines which are moſtly ſprinkled with natural wood, encloſed and planted, they would be converted into belts both for ornament and ſhelter. There are alſo many ſtony places, which do not admit the plough; but are well adapted for trees. Were all the parts in Arran which are fitted for trees, and nothing elſe, planted, and the trees preſerved; in a courſe of years the wood would

would be of more value than the island is at present. In those places where clay marl was described to abound, where there are sheltered dells, and hanging banks with a southern exposure, and marly bottom, fruit trees would thrive admirably, and be productive of much profit.

CLIMATE.

THE climate here is considered as rather moist, though the opposite extreme prevailed while I sojourned in Arran. The gravelly and sandy soils need much rain; and it is only by frequent repetitions of moisture, that they can be brought to carry either corn or grass. They have another defect, that all the putrescent manures applied to them are mostly washed through the soil in one season; so that their application is like pouring water into a sieve. Clay marl, where it is near, has been recommended as the most powerful and most permanent corrective of the defects of these soils. Where it is remote, mossy or earthy composts may supply its place.

With regard to temperature, this island, and other places on the west coast, intersected by the sea, are not understood to be so warm in summer, nor so cold in winter, as other places on the same parallel, and of the same elevation, on the east.

Nor

Nor does the medium temperature vary ſo much, as it does in the broadeſt part of the iſland, towards the ſouth of England. Still leſs does the temperature vary ſo much, as it does on the ſame parallel, on the oppoſite continents of Europe and America.

In Arran, ſnow ſtorms come from the north-eaſt, or eaſt. Having many mountains to croſs before they reach the iſland, they are moſtly exhauſted before they arrive. Though ſnow ſometimes lyes long on these granite mountains, it ſeldom remains a few hours on the low grounds; and, on the ſea-ſhores it is ſpeedily diſſolved.

This marks the adaptation of this iſland, and of other places ſimilarly ſituated, for winter crops of every kind. Towards the ſouth of Arran, where clay predominates, or the ſoil can be corrected by clay marl, wheat would thrive admirably. The ſoil and climate both admirably cooperate for raiſing turnips, yams, potatoes, and every ſpecies of roots; vetches, ſown graſſes, and every ſpecies of green crop. Nor is the climate and ſoil leſs favourable for improving the natural herbage which grows upon the mountains, or higher grounds, as already pointed out.

In excurſions of this ſort, it is not poſſible to aſcertain the medium temperature of a climate, by regular obſervations, taken at the ſame place, and at certain hours of the day. I uſually carry a portable

portable thermometer in my pocket, and aſcertain the temperature at different times, when my attention is not attracted by other objects, and at different elevations from the level of the ſea. The late Dr Walker contrived a plan for aſcertaining elevations by the thermometer; which was founded on the degrees of heat at which water would boil, at the ſame time, and at different elevations. There ſeems to be no doubt but this plan would prove more accurate than barometrical meaſurement. But another idea of his, that different thermometers, at different elevations, would indicate degrees of heat, at the ſame inſtant, correſponding to theſe ſeveral elevations, does not ſeem to be ſo well founded. In fact, in elevated grounds, and even on the acclivity of mountains, the temperature is regulated more by local circumſtances, than by the abſolute elevation. Theſe circumſtances it is needleſs to enumerate; but they may be reduced to a few general heads—ſuch as the expoſure; the radiation of heat from the rocks; the wetneſs or dryneſs of the ſoil, &c.

Having loſt the record of the temperature of ſoils in Arran, I can only ſtate, from recollection, that wet ſoils varied from 44° to about 54° of Fahrenheit; while dry earth, expoſed to the ſun's rays, varied from 100° to 120°. In other places, I have known a highly cultivated, and well manured

nured ſoil, amount to 150°; while the temperature of the atmoſphere did not exceed 60°.

This ſhews the powerful effect of draining and cultivating land, in improving the temperature of a climate.

The following table, being a ſelection from many obſervations while I was in Arran, may ſerve to exhibit a general idea of the temperature of its atmoſphere, during ſummer. It is only neceſſary to obſerve, that the temperature, at high elevations, is often greater, on the ſame day, than that in the lower regions. But that is eaſily accounted for, by conſidering, that ſetting out in the morning, or early in the forenoon, the ſun's rays were increaſing the temperature of the places to which I aſcended, and more ſo, perhaps, that of thoſe which I had left. Often when I returned down to the place from which I ſet out, the temperature, in the evening, was much lower than when I left it in the morning; and lower than that on the tops of the mountains. This, from what is ſtated, may eaſily be accounted for.

The firſt column exhibits the day of the month; the ſecond, the time of day when the obſervation was made; the third, the place, or local ſituation; the fourth, the temperature by Fahrenheit's thermometer; the fifth and laſt, general remarks.

TEM-

TEMPERATURE OF ARRAN.

1803.

Day of Month.	Hour of Day.	PLACE.		REMARKS.
June 29.	11 A.M.	Above Arran Parks -	68°	Calm, ſunſhine.
	1 P.M.	Shoulder of Goatfell -	62°	Do.
	2 P.M.	Top of Do. -	61°	Do.
	5 P.M.	Arran Caſtle - - -	69°	Do.
30.	11 A.M.	Bottom of Glenroſa -	61°	Do.
	2 P.M.	Head of Do. - -	69°	Do.
July 1.	Noon.	Head of Broddick Bay	66½°	Cloudy, ſome rain.
	4 P.M.	Top of Clachnadun -	61°	Do.
8.	1 P.M.	Head of Monymore Glen	58°	Do.
	3 P.M.	Top of Garbin - - -	51°	Do.
10.	Noon.	Lamlaſh Iſland - - -	73°	Calm, ſunſhine.
	2 P.M.	Do. - - - -	70°	Breeze from ſouth-weſt.
	3 P.M.	South Point of Do. -	65°	Breeze increaſed, cloudy.
11.	1 P.M.	Lamlaſh village - -	70°	Calm, ſunſhine.
13.	Noon.	Do. - - - -	73°	Do.
	5 P.M.	Whiting Bay - - -	71°	Do.
14.	8 A.M.	Do. - - - -	65°	Do.
	Noon.	Head of Glen Aſhdale	73°	Do.
	3 P.M.	Top of Knocknecarleu	76°	Do.
	5 P.M.	Near the ſea-ſhore - -	76°	Do.
	9 P.M.	Do. - - - -	70°	Do.
15.	Noon.	Near Lamlaſh - - -	78°	Do.
		Heat of ſoil at ſame place	122°	Do.
18.	2 P.M.	Kildonnan - - - -	76°	Do.
	3 P.M.	Do. - - - -	79°	Do.
24.	3 P.M.	Holme of Sliddery -	62°	Some rain.
				Showers continued from time to time for ſeveral days.
Aug. 2.	—	- - - - - - -	—	Loud thunder, with hail and heavy rain.
3. 4.	—	- - - - - - -	—	Showers continued.
7.	Noon.	Sea-beach - - - -	62°	Broken clouds.

TEMPERATURE OF ARRAN continued.

Day of Month.	Hour of Day.	PLACE.	°	REMARKS.
Aug. 8.	10 P. M.	- - - - - - - - -	—	Loud thunder, heavy rain.
10.	2 P. M.	South-End - - - -	59°	Thick fog, afternoon heavy rain.
12.	Noon.	Do. - - - - -	63°	Sunshine, breeze S. W.
14.	2 P. M.	Auchinreach Farm - -	68°	Do.
	3 P. M.	Do. - - - - -	70°	Do.
15.	1 P. M.	Moors above Glen-Scordel	75°	Calm, sunshine.
	3 P. M.	Glen-Scordel - - -	75°	Do.
	6 P. M.	Do. lower down - -	70°	Do.
22.	Noon.	Darineach Farm - -	60°	Thick fog, followed by heavy rain.
	7 P. M.	Do. - - - - -	54°	Do.
				During several days weather irregular, and some excessive rains.
29.	2 P. M.	Top of Ardvein - -	48°	Showers, wind north.
Oct. 14.	Noon.	Arran Castle - - -	60°	Sunshine, breeze S. W.

This was the day I left Arran; but many variations of weather, and excessive rains, occurred in the intervals, when I either had not time to observe the temperature, or, if observed, did not make an accurate record.

MANU-

MANUFACTURES.

KELP.

QUANTITIES of kelp are manufactured along the ſhores of Arran, on account of the proprietors. The people who conduct the proceſs are allowed a certain rate *per* ton, or they obtain a deduction from their rent to the amount that may be agreed on. This manufacture does not ſeem to be profitable, either to proprietors or to tenants. It is very unprofitable to the proprietors, becauſe the kelp is generally ſo bad, that they ſeldom get more for the article than will cover expenſes; and by diverting the labour of tenants from their land, at the moſt important ſeaſon of the year, the manufacture of kelp contributes to prevent that increment of value, and riſe of rent, which their labour would ſoon convey to the land. Indeed, until proprietors adopt a judicious diviſion of farms into ſeparate poſſeſſions, no man can be expected to labour more upon land than uſage demands; and he cannot be ſuppoſed to go more heartily into the buſineſs, than a decent regard to appearances requires. To expect more, would be to ſuppoſe him a fool, or a madman. It is needleſs, therefore, to ſhow how this diverſion of the

 farmer's

farmer's labour is prejudicial to him. It may be received as a maxim, that whatever diminishes the landlord's rent, is prejudicial to the farmer, and *vice versa.* Put it in the power of a tenant to make himself rich, and he will soon make his landlord rich: but involve the latter in a system by which he must, of necessity, remain poor, and his landlord will not derive one tenth part of the benefit from his labours he otherwise might; and this is the present state of the island of Arran.

A great part of the sea-ebbs of Arran are unfavourable to the growth of sea-weeds. The rocks are mostly sandstone, or micaceous schistus, or slate, or puddingstone, &c. which do not afford a sufficiently solid, or smooth surface, to which the weeds can attach themselves. Great tracts are also occupied by rounded stones, which are moved and tossed by every storm, so as to wear off every plant which may have fastened itself to such stones. In the bays, soft mud, or sand, prevails, to which no sea-plant can attach itself.

These plants seem to attach themselves to rocks, by taking advantage of the same law of nature, which many species of shell-fishes employ, in order to produce their adhesion to rocks. This is by creating a partial vacuum, or exclusion of air, from between the root, or rather basis of the plant, and the stone; which occasions the root to be pressed towards the stone by all the difference

between

between the weight of the atmosphere, and the partial vacuum within. Of this we have an illustration in the way that boys amuse themselves by pulling up large stones, by wet rounded pieces of leather, with strings fastened in their centre. When a piece of this leather, in a pulpy state, is applied to a stone, and pulled by the string, at right angles to its surface, a partial vacuum is produced, which causes the atmosphere to press violently on those parts of the leather in contact with the stone, from which the air has been withdrawn towards the hollow, formed by the pull of the string. As long as the leather remains moist, the atmospheric air cannot re-enter the space betwixt it and the stone; and the stone must be considered as a body glued to the leather, by the pressure of the atmosphere.

Most shell-fishes, which adhere to rocks, have a slight degree of locomotive power, and if dexterously surprised while attempting to move, or while holding themselves open to catch prey, they may be turned over by a straw. But if they be alarmed, in the slightest degree, they instantly throw out numerous air-bubbles, and fasten themselves firmly to the rock. This is evidently a process by which they create a partial vacuum in their shell, and exclude the air, which the pulpy membrane round its mouth prevents from returning, just as was described in the boy's sucker. If the rock be

be ſmooth to which they adhere, they can ſeldom be removed without breaking the ſhell. But if it be ragged, or arenaceous, they can eaſily be turned over by thruſting a ſpike into an inequality below the rim of the ſhell.

Sea-plants derive no ſubſiſtence from their roots, which only ſerve to fix them upon the rocks. They poſſeſs no locomotive power, like the ſhell-fiſhes; but I am confident they adhere to the rocks from the ſame cauſe. I have often tried to diſengage them, and thought they parted more eaſily when attacked by ſurpriſe, than when warned of my intentions. They ſeem to poſſeſs a power of increaſing the vacuum which binds them to the rocks, in proportion to the violence with which they are aſſailed. That ſea-plants are bound to the rocks by atmoſpheric preſſure, I am fully convinced; and that they *poſſeſs a power* of increaſing this preſſure, by rarefying the vacuum which occaſions it, ſeems highly probable: but, in the caſes alluded to, the eaſe with which a plant could be diſengaged from the rock, or ſtone, to which it adhered, might be owing to ſuperficial inequalities in the rock, or to ſoftneſs and poroſity, which obſtructed the formation of a vacuum; thoſe upon ſmooth and hard ſtones, adhering moſt firmly. The opinions advanced acquire additional confirmation from this circumſtance, that theſe plants always grow with greateſt luxuriance where currents

rents are ſtrongeſt, or waves moſt violent; provided there be proper rocks on which they can faſten. This ſhows that their power of creating vacuum, or their means of adheſion, is proportioned to the violence with which they are aſſailed.

It is needleſs to enter into a deſcription of the various tribes of marine plants, as they are well known. Each tribe grows at a particular depth in the ebb, with all the regularity of the zones of the globe. In Arran they grow beſt upon whinſtone veins, or upon large ſtones within tide. On ſandſtone and puddingſtone, &c. they grow very imperfectly. Many places might have large ſtones rolled down from the beach, to increaſe the ſurface occupied by marine plants.

Nor is the beach favourable for burning the plants into kelp, as it affords no turf, and is moſtly occupied by ſand, or ſtones. Hence much of it vitrifies with the ſand, and it is often contaminated with ſtones. It hence ſeems expedient to adopt Colonel Fullarton's kilns here; and theſe might be eſtabliſhed at the north and ſouth ends, where great quantities of plants are frequently drifted in. Theſe kilns might be conſtructed upon a flat-bottomed boat, which might move round from creek to creek, and conſume all the ſea-weeds in ſucceſſion. I am confident that other valuable products, beſides alkaline ſalt, might be extracted from

from ſea-weeds, and that theſe plants might acquire a great value. Were this plan adopted, the management of them might become a ſeparate profeſſion; and the ſeparation of profeſſions is of great importance in the Highlands and Iſles.

If ſuch kilns as Colonel Fullarton's are not adopted;—on ſuch beaches as thoſe of Arran, kilns of the uſual dimenſions and form ought to be conſtructed with fire-bricks, with moulds of the ſame to receive and cool the liquid kelp; and to operate night and day, until all the plants within their reach are conſumed. The bricks may then be removed to another ſtation; or the whole apparatus may be erected and carried round, on flat-bottomed boats.

IRON, &c.

THE two ſtreams of North and South Sannox, might eaſily be made to unite, and to afford water-falls of great power. Here a manufacture of bar-iron and ſteel might be eſtabliſhed with every proſpect of ſucceſs. Were the natural woods along this coaſt properly managed, they might afford an abundant ſupply of charcoal.

Here alſo a pottery might be eſtabliſhed, having moſt of its operations performed by water-force, and the materials furniſhed by the iſland itſelf.

itself. Other ſtreams have been pointed out, which are adapted for machinery of great power.

Wool, Lint.

It has already been ſtated, that the women manufacture moſt of the woollen cloth that is uſed in the iſland. There is a dyer and fuller eſtabliſhed near Lamlaſh, who dreſſes the cloth, and it is far from being inelegant. I have often admired the brilliancy of the Highland dyes, and aſcribe it partly to the purity of their water. There are ſome ſtrong chalybeate ſprings among the ſouth hills of Arran; but, in other caſes, the ſprings are remarkably pure. Were the mountains ſubjected to a proper ſyſtem of ſheep-farming, it would be eaſy to ingraft upon the knowledge the people have already acquired, a woollen manufacture. Many of the operations, ſuch as carding, roving, &c. might be performed by water power; and where the hand is neceſſary, the women are already well qualified to execute the work.

Small patches of excellent lint are raiſed in Arran, and ſpecimens of very fine linen are manufactured. But they labour under inſurmountable diſadvantages. Having no lint-mill in the iſland, they are obliged to carry the lint to mills on the mainland, in order to be dreſſed. Were

a lint-mill or two conſtructed here, the growing of lint, and the manufacture of linen, might be carried to a great extent. Though lint be reckoned a ſcourging crop, this can have no effect where there is ſuch abundance of manure.* It has one advantage, that it requires the land to be very clean, and highly pulveriſed; and it anſwers better than barley for ſowing graſs ſeeds. The women here are excellent ſpinners; and were obſtructions only removed, a linen manufacture is likely to flouriſh without further encouragement.

FISHERIES.

FISHERIES.

The late Reverend Gersham Stewart, in conjunction with some gentlemen at Glasgow, endeavoured to establish a white fishery in Arran, with a view to supply the city of Glasgow with fish. Their plan was, to land the fish at Saltcoats, and from thence convey them to Glasgow on the backs of horses. But the roads at that time were very bad, and the citizens of Glasgow did not discover such a relish for fish as they have done since. The consequence was, that all the zeal of Mr Stewart was not able to keep the scheme alive; for, after languishing some time, the project was dropped.

Were the intended canal from Ardrossan to Glasgow completed, several parts of the island of Arran would become most advantageous fishing stations; and this canal would infuse new life into all the fisheries of the West Highlands. A boat loaded with fish, entering the canal at Ardrossan, would reach Glasgow in six hours, passing by Paisley, and an almost continued chain of manufacturing towns and villages.

A colony of fishers from Nairne and Banff-shires, has long been established at Ayr. These people

people are very induſtrious, and are ſaid to have made fortunes. They ſend detachments to different parts of the coaſt of Arran, to fiſh during ſummer. Their fiſh is landed at Ayr, and conveyed to Glaſgow, and ſometimes even to Edinburgh, by land.

The fiſh caught in theſe ſeas are cod, ling, congor eels, haddocks, and a variety of ſmaller fiſhes; ſkate, flounders, ſoles, turbots, lobſters, partons, and various ſhell-fiſhes.

In order to improve the fiſheries here, portions of the population ſhould be detached from the land, and induced to derive the whole, or greateſt part of their ſubſiſtence, from this employment. At firſt, it may not be practicable to detach them wholly from the land; and they may have ſmall lots of waſte ground aſſigned them near the fiſhing ſtations, to be encloſed and cultivated during the intervals of fiſhing. I met a man at Currie, who offered to take three or four acres of the waſte land above the bank, at 20s. per acre, on a nineteen years leaſe, to encloſe, and reduce it into cultivation. He alſo offered to build a ſubſtantial houſe of two ſtories, near the harbour, on a building leaſe of ninety-nine years, which might ſerve the double purpoſe of a dwelling and ſtore-houſe; and to devote the greateſt part of his induſtry to the fiſheries. This would certainly be a lucrative ſpeculation for proprietors, becauſe the land he propoſed

propofed to enclofe and cultivate, does not now yield a penny per acre. Were this plan carried into effect at all the fifhing ftations, much wafte land might be reclaimed, which, when the leafes expired, might be affigned to farmers, as the fifhers would now find it to be for their advantage to devote the whole of their attention to their proper employment.

The ftations proper for fuch eftablifhments in Arran, are, 1. At Loch Ranfa, where nature has formed a moft commodious harbour, which a trifle of expenfe would improve. 2. At Currie, where there are two harbours cut out of the folid rock, which might be very much enlarged; and the fale of the ftones would amply defray the expenfe. 3. Below Arran Caftle, where a fmall harbour might be cut in the fandftone ftrata, to which the ftones would form a parapet. 4. At Lamlafh, where a very elegant harbour was moft imprudently demolifhed. This harbour might prove a great accommodation to general trade. It would be an excellent fituation for building and repairing fhips; and might be conftructed by a fmall anchorage rate on the numerous veffels which frequent the bay. As an equivalent for this rate, buoys might be dropped to mark the entrance into the bay from the north, fo that veffels might enter with equal fafety at either end. 5. At Whiting Bay, where the people have already made a

fmall

ſmall harbour, by arranging the ſtones upon the beach. 6. On, or oppoſite to, the iſland of Pla-da. 7. Below the farm of Corrychrevy, on the ſouth end. Here a bank is ſaid to extend from the Iron iſland, acroſs the frith, to the rock of Ail-ſa, which ſwarms with cod, ling, haddocks, and various other fiſhes. 8. At the mouth of Black-water, oppoſite to Campbeltown. 9. At Machry, as already deſcribed.

Each of theſe ſituations poſſeſſes peculiar ad-vantages; and were any one of them occupied by ſkilful fiſhers, much benefit would reſult, not only to Arran, but to the country at large.

Shoals of herrings often frequent the coaſt of Arran; and this is the only fiſhery in which the people here ever engage. It is chiefly proſecuted by young men, in ſmall boats, who repair to Loch-fine, or wherever the herrings are known to a-bound. They are ſold to *coupers*, or hawkers, who convey them to market in a freſh ſtate; or to buſſes, which come provided with ſalt and caſks for curing them. In 1803, this fiſhery was ſup-poſed to bring into Arran from 1500l. to 2000l., beſides conſiderable quantities of herrings, cured by Iriſh ſalt, for their own conſumption. The young men who engage in it, generally make as much as maintains them all the year; and unleſs they embark in a trading voyage, they paſs the remainder of their time in idleneſs. This ſhews the

the neceſſity of combining the white with the herring fiſhery, as by ſo doing the fiſhers might have conſtant employment all days of the year.

The Government bounties on the herring fiſhery were intended originally to excite the Dutch mode of fiſhing in the deep ſea; though in no caſe have they been productive of that effect. They ſeem to have failed, from the aſſumption, that ſuch large and expenſive veſſels as the Dutch employ, at a great diſtance from their ports, were neceſſary in the land-locked ſeas of the Weſt Highlands, where, if ſtorms ariſe, a veſſel can, in a few hours, reach a ſafe harbour. It would appear that veſſels of from 15 to 20 tons, half-decked, and furniſhed with a ſufficient length and depth of nets, would be amply ſufficient for the deep fiſhery in ſuch ſeas. Or ſuch veſſels and tackle as are uſed at Yarmouth, might be employed with advantage. Each veſſel ſhould have a cooper, and a ſufficient aſſortment of ſalt and caſks; and the men ſhould gut and cure, during the day, all that were taken the preceding night. When a cargo is completed, they can return with it to their port, where it is to be repacked and more attentively cured by the people on ſhore. Meanwhile the veſſel may return for another cargo; and, in this way, many cargoes may be completed in the courſe of one ſeaſon.

The

The advantage of this would be two, or perhaps three, months added to the period of fiſhing; and when the herrings removed to the bays or coaſts, ſuch veſſels might follow them, and take them with more effect than the ſmall boats and nets now employed. When the herring fiſhery ceaſed, ſuch veſſels would be well adapted for the long lines uſed in the cod and white fiſhery. Thus fiſhing, inſtead of being an occaſional employment, awkwardly conducted, would become a diſtinct profeſſion, proſecuted all days of the year, with vigour and effect. I conceive Government ſhould endeavour to incite a few to try this experiment, by ſuitable encouragements.

For the North-weſt Highlands and Iſles, from which markets are more remote than they are from Arran, well-boats ſeem indiſpenſably neceſſary to the proſperity of the fiſheries, in order to convey part of their produce to market in a living ſtate. According to the direction of the wind, theſe boats might furniſh an abundant ſupply of fiſh, not only to the towns on the weſt of Scotland, but alſo to thoſe on the weſt of England, and on the north and eaſt of Ireland. They might alſo bring back groceries, and many other articles, which the want of regular intercourſe cauſes to be of enormous price, and of very bad quality, in the North-weſt Highlands and Iſles.

Beſides

Besides the cod, ling, haddocks, &c. which may be conveyed alive in well boats, the coasts of Lewis, and of other Isles I have visited, swarm with lobsters, partons, &c. of the most enormous size and delicious flavour. Many bays of Lewis, of Skye, and on the opposite mainland of Ross and Invernessshires, which I have seen, abound with oysters of excellent quality; and I doubt not but they may also abound in many other bays, which I had no opportunity of examining. These could be conveyed, alive, to very distant markets in well-boats; and each species, in its season, might afford constant employment to such boats. What could not be instantly sold, might be pickled and preserved for future use.

It is obvious these seas cannot be properly fished by vessels coming from distant ports; and the end can only be attained by capitals, vessels, and a numerous population of expert fishers, distributed at all those stations which are nearest to the scene of action. Well-boats would return ready money, or goods, for part of the produce, and enable the fishers to wait the more distant returns for their pickled produce.

The great advantage of Arran, as a fishing station, is its access to markets where much of the produce may be sold in a fresh state. But an ample store of salt is necessary to preserve what cannot be so disposed of, otherwise the fisheries cannot be

 prosecuted

prosecuted with advantage. The drawback of the duties allowed by Government, is loaded with so many formalities, obligations, and penalties, that very little advantage results from it to the fisheries. The quantity of salt diminishes from dampness; and thus, neither an overplus, nor deficiency, can be accurately accounted for. Hence no advantage is taken of this drawback of duty by the people on the spot; and the only people who profit by it, are those who fit out vessels from ports very remote from the scene of the fishery. Often vast shoals of herrings come into bays, where there are none of these vessels with their salt and casks; and when they do arrive, they combine to impose what price they please upon the small-boat fishers, who have no other market for their produce, in situations where the herrings cannot be disposed of in a fresh state. The case would be very much altered, were salt, free of duty, and of every restraint, put within the reach of every crew which could fit out a boat. They would prosecute the fishery with redoubled assiduity; and the present busses would become mere coasters, whose only business would be to go round, and convey the cured fish to a market.

Mr Addington's plan of repealing the duty on salt, seems to have failed, from not being able to find a substitute. Meanwhile, my ingenious friend Mr Fraser, in his letter to Mr Abbot, proposes that salt should be allowed to be imported to all the

the fiſhing diſtricts of the Highlands and Iſles, free of any duty or reſtraint whatever. It appears from his ſtatement (though I have not his pamphlet before me), that all the revenue ariſing from ſalt in theſe diſtricts, does not amount to 200l., while its collection coſts many thouſands. Thus ſuch a conceſſion, ſo far from coſting Government any thing, would prove a great ſaving of expenſe. He propoſes to render the ſmuggling of this ſalt, into the diſtricts liable to the duty, felony. I have no objections to make the penalty very high; though I ſee no uſe for ſuch ſeverity. It would not be the intereſt of the people to ſmuggle this ſalt, but to export it in combination with fiſh: and men are ſeldom ſeen to commit crimes which are manifeſtly contrary to their intereſt.

Mr Fraſer does not advance this propoſition as a ſpeculative theory; but refers to the Iſle of Mann, where it has long been eſtabliſhed; and where, without creating the ſlighteſt tendency to ſmuggle, it has been productive of the moſt beneficial effects on the fiſheries. I conceive Government need not heſitate to try this experiment during a limited period, in the fiſhing diſtricts pointed out by Mr Fraſer.

But the ſucceſs of the fiſheries does not ſolely depend on having ſalt cheap and abundant in every cottage of the Highlands and Iſles: the ſalt muſt

muſt alſo be of the utmoſt purity, and adapted for the preſervation of fiſh in all latitudes.

The bay ſalt, though highly cryſtallized, is mixed with ſo much mud and ſediment, waſhed down by rivers, and beat back by the ocean, that it carries the *fomes* of putrefaction in its compoſition; which the perfection of its cryſtals may reſiſt, but cannot wholly counteract. Accordingly, the Dutch never uſe this ſalt, without melting it down in pure ſea-water, which they bring from a great diſtance; allowing the ſediment to depoſit; and afterwards ſubjecting the limpid ſolution to a new cryſtallization.

But why have recourſe to St Ubes, or to any Saint that ever exiſted, for materials which the Britiſh iſland furniſhes in the utmoſt abundance?

At an early period of my life, from pedeſtrian excurſions into the Highlands, where I happened to ſtumble upon lochs or bays where the herring fiſhery was going on, this ſubject was forcibly impreſſed upon my mind. I made numerous experiments, with a view to diſcover an eaſy and ſimple proceſs for purifying ſalt. At the commencement of the Highland Society, I gave in a paper, which they honoured with their firſt and higheſt premium. This paper they have loſt; and having preſerved no notes, my memory retains only a confuſed recollection of the particulars.

As

As far as my recollection extends, I think I ftated, that the fifheries required two fpecies of falt; one of fmall grain; the other in large cryftals; but both of the utmoft purity. I pointed out various modes of purifying the fmall-grained falt; the moft efficient of which, as far as I can recollect, were certain precipitates. With regard to the large-grained, or cryftallized falt, I defcribed feveral proceffes which I had tried; and the one to which I was moft partial, I fhall attempt to defcribe. It confifted of a broad and fhallow pan, placed above the pans in common ufe, to be charged with purified faturated folution of falt, which was to be cryftallized by the heat of the fteam emitted from the pan below. I prefented plans of fuch a work, by which it was made evident, that while fmall-grained falt was boiled in the pan below, the heat of the upper pan might be regulated by a thermometer, and might produce all the perfect cryftallization of the warm climates, without any of the putrefcent ingredients which there adulterate the falt.

My ingenious friend Dr Coventry has lately invented a method, fimple and effectual, for purifying fmall-grained falt of the *magnefia falita*, and other deliquefcent falts, which render marine falt incapable of preferving fifh, and of other ufeful purpofes. Far be it from me to divulge what was communicated in the confidence of friendfhip; but I

I conceive that Parliament, and public bodies, are called upon to elicit, by ſuitable remuneration, the divulgence of the Doctor's ſecret. The good—I may even add—the ſafety of their country, loudly demands this meaſure.

Moſt of our Scottiſh ſalt pans, and even thoſe of England, are ſituated in the mouths of rivers, where the proportion of ſalt is much diminiſhed by the freſh water which mixes with that of the ſea. The ſalt water uſed in the pans is likewiſe conſtantly muddy, and charged with much putreſcent matter waſhed down from the land. To get rid of theſe ingredients, a liberal uſe of blood is neceſſary, which conveys to the ſalt a nauſeous flavour, and impregnates it with a putrefactive *fomes*.

On the ſhores of ſmall iſlands, ſea-water is always clear and limpid, and might be boiled into ſalt without any uſe of blood. It is alſo much ſtronger in ſalt than the brakiſh water at the mouths of rivers. Hence an iſland is the moſt proper ſituation for a ſalt-work, which is to furniſh ſalt of the purity and perfection requiſite for the fiſheries. This has long been impreſſed upon my mind as an indiſputable fact; and after viſiting many iſlands, I have at laſt fixed upon the iſland of Arran as the moſt commodious for eſtabliſhing a great manufacture of ſalt, of ſufficient purity for the fiſheries. By the Crinan Canal, it has an eaſy

communication

communication with the other iflands and fifhing ftations on the mainland, all the way to Shetland. It contains coal well adapted for the purpofe of boiling falt, or can eafily be fupplied from Ayrfhire. When the Ardroffan Canal is completed, it can be fupplied with abundance of fmall coal, at a cheap rate, from coalleries in the interior country. *

Every attempt that has been made, to procure the importation of Englifh rock-falt into Scotland, has been vigoroufly refifted by the coal-mafters and falt-boilers, on the eaftern coaft. They alleged, not without reafon, that fuch a meafure would give their brethren on the weft too great an advantage over them; which would oblige them to abandon their falt-pans; render their fmall coal ufelefs; and, of courfe, render their coal-pits unprofitable.

But I fee no injury either party would fuftain by allowing the importation of rock-falt to the iflands of Arran or Skye, to be manufactured into falt folely appropriated for the ufe of the fifheries, or for exportation. It is certain that no particle of their falt was ever ufed in the fifheries, or exported.

I therefore propofe that a large manufacture of falt, from Englifh rock-falt and fea-water, fhould be eftablifhed at Lamlafh, or at the head of Brod-

* The author has lately difcovered much coal in the Ifle of Skye.

dick Bay. The work to have two pans: the lower to make ſmall ſalt, to be afterwards purified in Dr Coventry's method; the upper to make large cryſtals of ſalt, free of every putreſcent ingredient.

It is meant that thoſe who embark in this ſcheme ſhall ſell the ſalt at as low a price as ſhall cover expences, with a very moderate profit. That it ſhall be free of all duty, and paſs without the ſmalleſt reſtraint to all the fiſhing diſtricts pointed out by Mr Fraſer; but it muſt not paſs into the diſtricts where the duties are paid; and if any overplus is manufactured, beyond what the fiſheries can abſorb, it may be exported, but cannot be ſmuggled into the diſtricts liable to duty.

A manufacture of ſalt of the higheſt purity for the fiſheries, within the fiſhing diſtrict, I conceive would render Mr Fraſer's plan more ſimple and practicable. The permit of the manager of the work, would be a ſufficient guarantee for the conveyance of the ſalt, while it kept within its preſcribed limits; a ſecurity which could not be obtained were the ſalt brought from Liverpool, from Ireland, or other places. I conceive our Highland Society would be more profitably employed for their country, were they to deliberate on the means of carrying ſuch a project into effect, than while occupied with other matters, of far inferior importance.

Since

Since the above was written, the author has been favoured with the following letter from his ingenious friend Mr Frafer, which throws additional light upon the fubject; and fhews that the plan of granting falt free of duty and reftraint, which he procured for fifhing veffels in the ports on the Thames, has done no harm to the revenue; though, in thefe places, the opportunities of fmuggling are infinitely more numerous than in the Weft Highlands and Ifles of Scotland. The author's experiments on falt, and the beft means of applying it, were made when he was a very young man; and he did not know, until informed by this letter, that double pans had been employed in Ireland. This, however, only fhows that what he had tried on a fmall fcale, may be executed on a large fcale, with good effects; efpecially when improvements are fuperadded, which he fuppofes are not known in Ireland.

' *The Rev. J. Hendrick.*

DEAR SIR, *Perth, December 5. 1805.*

' I WOULD fooner have anfwered your obliging favour of the 25th of laft month; but not having a copy of my letter to the Speaker of the Houfe of Commons by me, I did not recollect the particulars you wifhed to be ftated. I have found a copy of my publication, which is perfect, excepting the map, which I take the liberty to en-

clofe

close you, and desire you may make what use you think proper of the facts or observations contained in it. To the arguments made use of to show that no injury can arise to the revenue from smuggling of such duty-free salt, as may be allowed to be made use of in the fisheries, the following observation, transcribed from a manuscript of mine, which I shall perhaps lay before the public next session of Parliament, appears decisive.

"By an act of the session of 1801, for the "better supplying the cities of London and Westminster with fish, both fresh and just salted, it "is enacted, That all vessels proceeding from "London, Gravesend, Greenwich, and other "ports in the Thames, shall be allowed to carry "out with them salt, for the purpose of curing "their fish, with a drawback of all the duties, "and without being subject to give any return of "the quantity of fish cured, or any account of "the quantity of salt wasted, &c.; entering only "into a bond, that the said salt shall be used on "board the said vessels. Experience has shewn, "that at *those* places where the temptation to "smuggle salt, from the high price of it, is *greatest*, there have been no complaints of any such "frauds, nor could there be any danger from the "same privilege being extended generally to all "fishing vessels, *since* the *salt* has been *put under the excise*, which took place in 1798, because "the

" the excise-officer takes an account of all the salt " kept by dealers, and could easily discover if the " quantity was increased by any illicit practice. " There is therefore no necessity for the Minister " to make any alteration of the present duties, " much less to repeal them, only simply to extend " the provisions of the said act to the fisheries in " general, and particularly to those in the High- " lands and Isles of Scotland. I further see no " reason why rock-salt should not be allowed to " be manufactured into culinary and fishery salt " *ad libitum*, in the same manner as tallow into " soap and candles; and I could easily prove that " the revenue would be greatly augmented by " such a general liberty, instead of its becoming " a monopoly as at present, in the hands of a few " very opulent individuals, some of whom have " acquired, in the neighbourhood of Liverpool, " fortunes of nearly half a million of money."

'The Scotch salt is certainly of very inferior quality to the Liverpool or Irish salt, made by refining the rock-salt, dissolved in sea-water. At the principal manufactories in Ireland, they have, for many years, been in the habit of using double pans, one above the other; the lowermost placed over a draw-kiln for burning lime, the profit on which pays for the fuel made use of. Before the late duty of 3l. per ton was put on the importation of rock salt into Ireland, there were

numerous

numerous manufactories along all parts of the coaſt of that iſland. But, except at Roe's manufactory at Ringſend near Dublin, I do not find they uſe any method for purifying the brine; nor do they make any quantity of great ſalt; ſo that they are obliged to get St Ubes ſalt for curing their proviſions, which is very expenſive. I fear it would not be eaſy to obtain the privilege of importing rock-ſalt to Arran. Colonel Fullarton tried to get ſuch a privilege for Saltcoats ſome years ago, but could not do away the oppoſition of the Eaſt-country ſalt manufacturers. It was a very blameable neglect of the Highland Society to loſe your papers on the purification of ſalt. If that Society would bend their attention to the object of obtaining duty-free ſalt *ad libitum* to the fiſheries, they would do more good than by all their other operations. I have a very valuable paper in my poſſeſſion, containing a propoſal from a great many Dutch families to ſettle in the Highlands or Weſtern Iſles, bringing their capital and induſtry with them for carrying on the fiſheries. I had alſo a repetition made to me by the Americans, mentioned in Dr Anderſon's letter, publiſhed in the appendix to my letter to the Speaker. But although both theſe important circumſtances were communicated to the Miniſter, during the late peace, by the Earl of Breadalbane, Mr Addington the then miniſter did not deign ſo much as to

give

give his Lordship an answer to his letter. At present, it is not possible to expect a better fate; although Mr Pitt certainly declared to a friend of mine, who presented him with my pamphlet, that if ever he came into administration, he would act upon it. And I think, if things had not turned out so adverse, that he would have done so. Nothing can be expected, however, in the present circumstances of the country, where all our efforts must be directed to preserve us from being swallowed up by that power which seems to carry every thing before it.

'I should be very glad to have it in my power to render your talents and industry useful to yourself and the country; and there are some measures in contemplation that in the course of next summer I think may enable me to do so, and which, be assured, I shall not omit mentioning to you as soon as they come to any bearing.

'And I remain, yours truly, R. FRASER.

'*P. S.* Is Dr Coventry's process for purifying small salt published?—I should be very glad if you could come and stay a week or two with me here.'

On the best method of preparing and purifying common salt, several inquiries and experiments have of late been instituted, and different societies have offered premiums for information on the subject. Such exertions on the part of individuals and societies, not only demonstrate the sense which the public have of the importance of this investigation,

but it forms an important link in the chain of evidence which I have attempted to adduce respecting what Government should do towards the establishment of the fisheries of these kingdoms. There can be no doubt, but that when the dangers hinted at by my friend *Mr Fraser* are removed, and Government can calmly and deliberately turn its attention to this great national object, the ideas of all the men of science and of observation, who have turned their attention towards the subject, and who have no personal interest to serve in what they propose, will be adopted and acted upon.

That common salt is chiefly composed of the muriate of soda, is a fact which has been long and generally known. But there are other salts combined in sea-water and in rock-salt, from which the saline ingredients of the sea seem to have been derived, which possess qualities very different from those of the muriate of soda, and which, when mixed with it in considerable proportion, tend greatly to destroy its antiseptic power, and, of course, its use for culinary purposes. These adventitious salts which debase common salt, so far as yet discovered and deserving of notice, are,

1. Muriate of Magnesia.
2. Sulphate of Magnesia.
3. Muriate of Lime.
4. Sulphate of Lime; and,
5. An occasional admixture of Sulphate of Soda; for this last mentioned salt is not universally present, either in sea-water or in rock-salt.

It

It may be laid down as a general principle, founded in experiment and obfervation, that falts with earthy bafes are, with few, if any exceptions, not only unfit for culinary ufes, but produce or promote the rapid decompofition of all animal fubftances. Such, therefore, are unfit for preferving either butcher-meat or fifh; and, as already hinted, the more thefe faline impurities abound in common falt, the lefs adapted is it for that purpofe.

Various conjectures have been formed to explain how fuch a defcription of faline matters produces this effect. It is not improbable, but falts with earthy bafes act on animal fubftances in the way of double elective attraction. The putrefaction or fpontaneous decompofition of animal fubftances, by the new combination of their principles, generates alkalis, which, uniting with the earthy falt in contact with it, decompofes it by abforbing its acid, for which acid the alkali has a greater affinity or attraction than the earth. Thus it happens that earthy falts and animal fubftances effect their mutual decompofition; and unlefs there were a predominant, or counteracting proportion of muriate of foda, or fome other falt of an alkaline bafis, which no ingredient exifting, or forming, in the compound, was capable of decompofing, the application of earthy falts alone, would produce a more rapid decompofition of animal fubftances, than if left to their own tendency towards putrefaction.

 Whether,

Whether, however, the opinion now submitted be well-founded or not, it is certain that salts of earthy bases operate the destruction of animal substances exactly in the ratio of their solubility in water. This liquid conveys the salt into every pore or interstice of the animal substance, and so places it where it can either resist or promote decomposition.

1. The most soluble, as well as the most generally diffused, and the most copious of the earthy salts which contaminate common salt, whether derived from saline rocks or from sea-water, is the muriate of magnesia. It is chiefly to its presence that the bitter, unpleasant taste both of sea-water and sea-salt is owing: and it not only gives to the latter an unpalatable or nauseous taste, but it lessens greatly its antiseptic power, or its value as a culinary article for curing fish or meat. It is this salt, too, which principally constitutes that liquor which remains in the salt-pans after the crystals of common salt have been collected, and which, from its taste, is known by the emphatical name of *Bitterns*, from which liquor, that well known medicine magnesia is precipitated.

The muriate of magnesia has an attraction for water so great, that it can hardly be reduced to a solid form, not indeed till it has been evaporated to a thickish consistence and then exposed to great cold. On exposure to the air it attracts moisture, or deliquesces. Now, as common salt chiefly consists

ſiſts of the muriate of ſoda, the chryſtals of which are leſs ſoluble in water than the muriate of magneſia, when the former are produced and removed from the mixture, they contain, locked up in them as it were, and exteriorly attached to them, a conſiderable proportion of the latter; to the preſence of which, common ſalt chiefly owes its tendency to become damp, and, in ſome caſes, when the other occurs in a great proportion, its actual deliqueſcence. The rapid way in which the evaporation of ſea water is conducted for the purpoſe of preparing ſmall ſalt from the pans, is one cauſe to which the greater impurity of ſome ſorts of that article than others is to be aſcribed; but howſoever cautiouſly the boiling is conducted, it is extremely difficult, if not impoſſible, to get entirely rid of it. Indeed, in ordinary caſes, the expenſe attending ſlow evaporation is ſuch as could not well be defrayed by the price which that article brings when applied for common purpoſes,—the curing of herrings and the like.

Different opinions are entertained about the cauſe of the injury done to common ſalt by the remains of the bittern, or the admixture of the muriate of magneſia. Perhaps its injurious effect may be owing, as I am inclined to think, 1. to its extreme ſolubility; and, 2. to its being decompoſable by vol-alkali, which is readily evolved in the decompoſition of animal, and even of many vegetable ſubſtances.

2. Another impure salt, with an earthy basis, to be met with in common salt, is the sulphate of magnesia, otherwise called Epsom Salt, from the circumstance of its abounding in the water of springs near that place in England. This salt, used in medicine, may be collected either from such springs, or, as is now usually done, from sea-water; for it remains in the bittern after the common salt has been collected. Indeed, next to the muriate of magnesia, it is the principal ingredient in that liquor. This salt is much less soluble in water than the other saline impurity, the muriate of magnesia; and its deliquescence, like that of common salt, is chiefly owing to its being mixed with it; for it effloresces on exposure when pure or unmixed with the other salt.

This saline impurity, which has, like the other, a very bitter taste, though perhaps one less nauseous, is more soluble in water than the muriate of soda, and, of course, is apt to remain intimately confined in or attached to the crystals of the latter, when they are forming in the pans or evaporating vessel. At a low temperature, about 60° of Farenheit, this salt will dissolve in its own weight of water, and in three fourths of its weight, when the water is boiling hot.

3. The third deliquescent and pernicious salt, is muriate of lime. This salt, though its attraction for water be great, can be presented in a crystallized form in the ordinary heat of the atmosphere. It is

is hence less pernicious than muriate of magnesia; and is still less hurtful, in so far as the vol-alkali evolved in the decomposition of animal substances does not decompose this salt. It may be decomposed after the putrefactive process, which is a slow inflammation, has proceeded in far as to evolve, or generate, the fixed alkalis. But its existence in rock or sea-salt, though universal, is often so small in quantity as hardly to deserve notice.

These three being the principal deliquescent salts known to exist in common salt, which operate by insinuation into every pore of the animal substance to which they are applied; it seems less necessary to enter into any disquisition concerning sulphate of lime, which, from its extreme insolubility, seems only to effect the decomposition of animal substances by a sort of mechanical contact.

It has been already stated, that the most impure or injurious salts in the composition of common salt, are not only extremely soluble in water, but have their solubility very much increased by heat; whereas the muriate of soda is nearly of equal solubility in hot as in cold water.

On this principle, the Earl of Dundonald contrived a method of purifying salt, described in the first volume of the Transactions of the Royal Society of Edinburgh, by pouring upon it saturated solutions of pure salt of a boiling heat. These brought into solution the deliquescent, or highly soluble salts, carried them down through the mass, and caused them to ooze or drain from the vessel, whose

whose shape was that of an inverted cone. But it is evident this process required a considerable consumption of pure salt; and the impure salts, having no other force but their gravity to carry them down, this was counteracted by the corpuscular attraction; and a considerable proportion of them remained suspended among the particles of pure salt, like water in a sponge. Hence this purification was not only expensive but partial. Notwithstanding the past difficulty in procuring common salt in a pure condition, there is reason to hope, from the success of some recent attempts, that this important object will yet be accomplished. The simplicity and efficiency of Dr Coventry's plan, especially if combined with certain arrangements of smaller moment, have already been hinted at.

But it seems impracticable to carry any plans of this sort into effect without the aid and assistance of Government. In all the schemes hitherto adopted for the improvement of the fisheries, Government have uniformly aimed at attaining the end, without investigating the means indispensably necessary towards its attainment. They have acted like the projectors described by Dean Swift in Gulliver's voyage to Laputa, who had invented a new and more ingenious mode of building houses, than the vulgar and antiquated practice of beginning at the foundation, and building upwards. Instead of this, our ingenious projectors began at the roof, and built downwards.

ON

ON OSSIAN'S POEMS.

In the preceding part of the work, frequent mention is made of the popular traditions in Arran concerning Fioun Mac Cowl, and his heroes. Their notions correfpond remarkably with the poems publifhed by Macpherfon. Similar traditions prevail through the Highlands and Ifles, from Arran to Caithnefs. Many remains of rude forts derive their names from Fioun and his heroes. Of this we have an example in Dun-Fioun in Arran. I was fhown feveral graves that were faid to be thofe of his heroes. Of this there is an example at the junction of Loch Duich with Loch Luing, oppofite to Kintail. Here a large grave is fhown, marked out by rude ftones, which is faid to be the grave of Diarmid and his dog. This hero is the reputed anceftor of the Campbells; and, till of late, when the people of Argylefhire came here to the herring fifhing, they were wont to walk round this grave on their bare knees, in the courfe of the fun, and to perform many fuperftitious rites in honour of the hero's ghoft. A heap of ftones is alfo fhewn, on a rock detached from the fhore, which is faid to have

been

been his castle, or place of residence. Mountains also derive their names from Fioun and his heroes. Of this we have an example in the Cuchulin mountains in the island of Skye, which are supposed to have been named from Cuchulin, whom Ossian distinguishes as *King of the Island of Mist*. In the district of Slate, facing the mountains which are known by his name, the ruins of Cuchulin's castle are still shown, on a peninsular rock projected into the sea, and built of dry stone. In very remote and little frequented parts of the Highlands, I have heard poems recited, which were said to be poems of Ossian. Those who understood both languages, declared their inability to convey their sublimity and pathos in English; but on describing their subjects, I found some of them corresponded with those translated by Macpherson; others not.

In Glenco, the place is shown where Ossian is said to have resided, and to have passed the evening of his days. The wild and awful scenery of that place, the mountain torrents, the woods and heaths, make a conspicuous figure in his poetry, and are the source of most of his imagery; while the columns of mist, and the drifting vapours, sometimes hovering on the summits of these rugged pyramidal mountains, present even to the dullest imagination a lively idea of gigantic ghosts stalking from mountain to mountain; or chasing the

deer in the fields of air; or enjoying the feaſt in their airy halls, ſurmounted by a canopy of miſt.

It is not my intention to bring forward all the facts which ſatisfy me that there were traditionary poems among the Highlanders concerning Fioun and his heroes. Such as occurred to me ſhall be ſtated afterwards, if this work advances further.

But the univerſality of the traditions concerning Fioun, among a people ſcattered over ſuch an extent of country, who have no communication with each other, proves two things. 1ſt, That there were poems which celebrated his exploits. 2d, That theſe poems were indigenous, and not, as Mr Laing alleges, borrowed from Ireland. In fact, the traditions concerning Fioun, and remains of the poems, prevail more in thoſe places which have no communication with Ireland, than in the South Highlands which have communication.

It forms no objection to this, that the people commonly believe Fioun to have been a giant, and aſcribe exploits to him beyond the compaſs of mortal ſtrength. The people in the low country aſcribe exploits to Wallace, far beyond the power of human ſtrength. But would it be fair, from this circumſtance, to conclude that no ſuch man as Wallace ever exiſted?

Dr Johnſon ſhewed his critical acumen, by denying the Poems of Oſſian, while he believed in the ſecond ſight; a folly which is now explod-

ed

ed by the Highlanders themſelves. The want of manuſcripts is the great objection he urges. But the firſt compoſitions of all rude nations are in verſe, that they may eaſily be retained upon the memory. The firſt writing was upon ſtones; and it would take a very long time to write a heroic poem in this way; and after it was written, it would be much eaſier carried on the memory, than on the book. But the Highlanders had an order of bards, whoſe buſineſs it was to learn and recite their beſt poems, and to compoſe new ones on the exploits of their chieftains. Their language ſeems eaſily to run into verſe; for I have ſeen a herd lad, who could not read, keep a company in a roar of laughter a whole evening, by ſatirical ſongs againſt particular individuals. They muſt have been extempore; becauſe I was ſometimes the ſubject of them myſelf.

This argument ſeems equally to militate againſt the authenticity of Homer's poems. It is certain that writing was either not known, or very little practiſed, in Greece at the time he flouriſhed. Every word which he applies to verſe, indicates that it was not a thing written, but ſpoken, or ſung. Lycurgus is ſaid firſt to have reduced his poems to writing, that he might inflame the Lacedemonians with martial ardour; and Solon is ſaid to have methodized, and reduced them into their preſent form.

Such

Such of Ossian's poems as I have heard, appeared to be detached episodes; and whether Macpherson has used liberties with his originals, or tacked a number of them together, I cannot decide. But, that he had originals, either copied from the mouths of people, or from manuscripts, can hardly admit of doubt.

Nor do I see much in Mr Laing's argument of a similarity in the imagery and expressions of those poems, to the sacred Scriptures, and other compositions. Every poet who describes nature, must frequently introduce images and expressions similar to those used by others. Had Ossian been represented introducing lions, elephants, and animals he never saw nor heard of, the forgery would have been palpable. He introduces nothing but what is visible in a mountainous country, intersected by the sea, and diversified by islands. Had Macpherson been capable of composing these poems, he must have been the most extraordinary genius that ever existed. He must have contrived a system of manners very different from any thing he ever saw or read of; and must have confined himself within a selection of objects, peculiar and appropriated to the manners, without ever diverging into any circumstance which might betray his imposture. Walking on the slack wire is nothing to this.

Annexed

Annexed, is an extract from a letter relative to this ſubject from the Rev. Mr John Stewart, miniſter of Kilbride, with a note by the Rev. Dr MacKinnon.

' *Kilbride*, 14. *Jan.* 1805.

' In the account I gave you of the iſland, which my father made out for Mr Pennant, you will find what you want about Fingal. It is believed here, that Fingal took Arran for a reſting place, on his going to aſſiſt his allies in Ireland, having come down Loch Fine in boats, or birlings. He landed at Machrie, where there was a fine natural harbour, which I ſhowed you; reſided in the Coves on Drummodoon ſhore. There is a farm in that diſtrict, where he kept his feaſt of ſhells. You may remember a number of ſtones on the farm of Tormore. This is the place where he held a court of juſtice. One large ſtone, where the pannel ſtood, is called the Pannel's Stone. Arran was, at that time, well ſtocked with red deer. On Fingal's returning from Ireland, he ſpent ſome conſiderable time in hunting. It is ſaid that Oſſian died in this iſland. My father, when a young man, heard his poems repeated by the old people, the ſame that are recorded by Macpherſon, making ſome allowance for little alterations. Annexed you have a note I had lately on this ſubject from my friend Dr Mac-Kinnon.

Kinnon. Mr Laing is entirely wrong in what he ſays with regard to Oſſian.

" The learned Dr Samuel Johnſon, in his
" Tour to the Hebrides, aſſerts, in his uſual dog-
" matical manner, that there is not a book in
" the Gaelic language, that is an hundred years
" old. But the good Doctor ſhould have been
" better informed, before he ventured to make
" fu[illegible] aſſertion. For, in the Duke of Ar-
" gyl[illegible] library at Inverary, there is a book ele-
" gantly printed in the Gaelic language, as early as
" the year 1567; and, in the 19th page of that
" book, the author, Mr John Carſuel, ſuperin-
" tendant of the clergy in Argyllſhire, laments,
" with pious ſorrow, that the generality of the
" people under his paſtoral care, were ſo much
" occupied in ſinging and repeating the ſongs of
" their old bards, particularly thoſe that celebrat-
" ed the valorous deeds of Fingal and his heroes,
" that they entirely neglected the Scriptures, and
" every thing relating to religion.

" The whole of this book is compoſed in very
" pure Gaelic; but particularly, the dedication to
" the Earl of Argyll is written with more claſſical
" purity and elegance, than any compoſition I
" ever ſaw, either written or printed, in that
" language.

" This is not hearſay evidence, my friend; for,
" the laſt time I was at Inverary, I read the book

" from

" from beginning to end; and, in the course of " the evening, repeated to the Duke a summary " of its contents: for which his Grace thanked " me, in his usual mild and polite manner; ob- " serving, that he never before had met with " any person, who could give him any informa- " tion with regard to the subject-matter of that " book, though he had shown it to many whom " he thought were good Gaelic scholars."

(Signed) " J. M'K. "

FINIS.

D. Willison, Printer, Edinburgh.]